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THE

# MALAYAN AGRICULTURAL JOURNAL

DEPARTMENT OF AGRICULTURE
S.S. & F.M.S.

KUALA LUMPUR.

# Department of Agriculture, S.S. and F.M.S.

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THE

# Malayan Agricultural Journal

JANUARY 1930.

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## EDITORIAL.

**The Malayan Agricultural Journal.**

With the present issue, the Malayan Agricultural Journal enters upon a new phase in its existence. The form of the Journal has been changed; in future the policy of the Journal will be to serve as a medium for the presentation not only of the results obtained by the Malayan Department of Agriculture but also by means of reviews and abstracts to call attention to work accomplished in other countries and to comment thereon in editorials and general articles. Arrangements have also been made for the inclusion therein from time to time of articles by members of other Departments e.g. the Department of Co-operation and the Rubber Research Institute, the work of which is cognate to that of the Department of Agriculture.

Original articles will so far as possible be couched in non-technical terms. The publication of strictly technical work being in future undertaken in the form of Special Bulletins.

It is believed that by following these lines a definite want will be supplied, and that the Journal in its new form will enter upon an increased sphere of utility.

**Camerons Highlands.**

The publication in this number of the Malayan Agricultural Journal of Messrs Bunting and Milsum's paper on Agriculture at Cameron's Highlands and Mr. Dennett's note on Soils at Cameron's Highlands should serve a useful purpose in that it affords the first published general review of the agricultural possibilities of that region. At present public attention is focussed on this region to a very marked extent, and it seems likely that as soon as adequate access facilities thereto have been provided, development on a considerable scale will be undertaken.

In these circumstances, the policy which has provided for the performance of a certain amount of agricultural experimental work before the Highland region became fully accessible must be admitted to be wise and far-sighted.

It is now clearly established that the Highland regions offer conditions which are suitable for the cultivation of Tea, Coffee, Cinchona and other upland tropical crops, and it is to be anticipated that extensive developments are probably only a question of time.

In this connection attention may well be called to the necessity for timely action to avert the losses which accompanied the opening up of hill lands in so many other parts of the tropics owing to insufficient protection against soil erosion once the protective cover of Forest is removed. Only attention in this respect may save the country from great waste of potential fertility. In this connection a leaflet on this matter is in course of preparation by the Department of Agriculture at the request of the Resident of Pahang.

**Tea.**

A special Meeting of the Advisory Committee of the Department of Agriculture was held on Thursday December 12th for the purpose of discussing progress in relation to the development of the Tea Industry, at which various members of the planting public interested in this subject were also invited to be present.

The members visited the Experimental Tea Plantation at Serdang before the Meeting and inspected the experimental work in progress.

At the Meeting the subjects discussed comprised a review of the experimental work both at Serdang and Cameron's Highlands during the past year, the areas under cultivation and plans for assisting the further development of the Industry.

It was agreed that satisfactory progress had been made, the results obtained showing conclusively that both upland and lowland Tea could be grown very well under Malayan conditions. The actual area under cultivation in Tea in Malaya now totals some 1,500 acres, an increase of about 800 acres since the end of 1928. Programmes of work were discussed and it was decided to recommend that systematic experimental work should be commenced in the Highlands region as early as possible.

Provision has already been made for the erection during 1930 of an Experimental Tea Factory at the Experimental Station, Serdang, and this should facilitate research work and also the training of students at the new Agricultural School in methods of manufacturing Tea.

There should be a considerable opening for the consumption of locally produced Tea in Malaya itself, while in spite of the present congested condition of the tea market, there seems no obvious reason, in view of the proved suitability of Malaya for Tea cultivation, and of the large undeveloped areas adapted to this form of agriculture, why Malaya should not in due course take its place as one of the important Tea producing regions of the world.

**Research Work on Coconut Palms.**

Ever-increasing attention is being devoted to the science of Plant-Breeding, largely because of the very successful results obtained on the world's more important cereal crops. But the results obtained by the application of plant-breeding methods to annual crops such as cereals come to hand much more readily than when similar methods are adopted with a view to improvement of the semi-permanent and permanent crops of the Middle East, and for this

reason comparatively little selection work has been undertaken on these crops. For example, although there are some six million acres of coconuts in the tropics, the question of improving the crop by selection has hardly been touched, though the range of variation in cropping power of individual palms is so large, that the desirability of research work on these lines has been obvious for many years.

An effort is now being made to remedy this state of affairs and more attention is being devoted to Coconut research, not only on selection work but on other lines. In Ceylon, a Coconut Research Institute is being pushed forward. In Malaya, the article published in this issue indicates the position as regards selection work up-to-date, and the length of time involved (in this case 7—9 years) in necessary preliminary recording before the actual selection work can be undertaken, indicates the arduous nature of the task. Further developments in Coconut Research work are contemplated in Malaya. An Assistant Chemist has been specially appointed for Copra Research work; this work is now in hand and will be carried on to endeavour to discover the reason for the alleged inferiority of Straits Copra, and if possible to improve the standard of Copra from Malaya so that it will compare favourably with copra from other coconut producing countries. A Committee has been formed for the purpose of considering a comprehensive scheme of Coconut Research in Malaya and an account of the work of this Committee will be published in the next issue of this journal.

**Rubber Statistics.**

The article in this issue by Mr. J. Gordon-Carrie, on the statistics of rubber production, will be read with a good deal of interest, containing as it does, *inter alia*, information concerning the yield of rubber from small holdings in Malaya based on actual ascertained returns over the whole area of the Federated Malay States. There is no question that the yields so established are considerably in excess of what many people expected would be the case. No doubt at the present time there are a number of factors operating which have tended to bring the production of the small holder to a level which is probably appreciably higher than that which may be anticipated under fully normal conditions, on the other hand, it also illustrates how easy it may be seriously to underestimate vital factors in the absence of definite and reliable statistical information. The success which has attended the institution of the service of statistics for rubber inspires the hope that the project for making similar provision for other agricultural industries may be productive of equally valuable results in other directions.

**The Field Division of the Department of Agriculture.**

An important feature of a Department of Agriculture is the organisation provided for linking up the administrative head of the Department with the agricultural community of the whole country, for it is upon the efficiency of this organisation that the usefulness of the Department to the agriculturist largely depends.

On the one hand, this organisation should provide the means for affecting improvement in agricultural practice and methods through instruction, both by precept and practical demonstration, and through the dissemination of information on agricultural matters provided by the research workers of its own and allied Institutions. On the other hand, it should be capable of providing the administrative head of the Department with information relating to all agricultural matters throughout the country, including the problems which need investigation by the Research Staff of the Department.

In the Department of Agriculture, S.S. & F.M.S., the Field Division is the organisation provided to perform these duties. This Division has become evolved from the former Inspection Division. The duties of the Division as at present constituted were set out in an editorial in the issue of this Journal for December, 1924; since this, experience showed that some further modification was necessary in order to enable the Division to perform with full efficiency the task allotted it. The matter received full consideration at the Field Officers' Conference reviewed elsewhere in this issue, and the conclusions established thereat should materially assist in arriving at a decision as to desirable developments in policy in order to attain the object in view.

**Extensional Work in Ceylon.**

Attention may be directed to the review of the annual reports of the Ceylon Department of Agriculture which appears in another column. These reports are of special interest to Malaya in view of the many points of resemblance which the two countries possess. Particular interest attaches to the reports of the Divisional Agricultural Officers which represent the mechanism provided for conveying the application of the research work done to the cultivator.

In Ceylon, extensional work of this nature has special reference to the small cultivators and finds its parallel in the system of agricultural consulents which exists in the Dutch East Indies, the duties of these officers being by means of propaganda, demonstrations and competitions to endeavour to raise the level of cultivation and hence of production on small holdings.

In Ceylon and Java these activities are separated from official measures for the control of pests and diseases, the view being held that they cannot be suitably combined.

The success which has attended efforts on these lines demonstrates that therein lies the secret of increasing the productivity of small holdings and thereby the prosperity of the country as a whole, and the lesson to be learned therefrom should not be overlooked.

# AGRICULTURE AT CAMERON'S HIGHLANDS.

B. Bunting,
*Agriculturist*,

and

J. N. Milsum,
*Assistant Agriculturist.*

## Introductory.

During the past 6 years, considerable interest has been shown regarding the agricultural possibilities of Cameron's Highlands, Pahang. This interest has recently become intensified owing to the progress made with the road from Tapah to the Highlands and the efforts of the Department of Agriculture with the experimental cultivation of tea and other crops at Tanah Rata.

The Department of Agriculture commenced work at the Experimental Plantation at Tanah Rata in January, 1926, since when considerable progress has been made. Before describing the results so far obtained it is considered advisable to outline the general climatic conditions and flora of the Highlands. Reference also is made to the behaviour of the various hill crops and other plants under cultivation together with observations regarding their possibilities on the Highlands.

It must be appreciated that the development of Cameron's Highlands is as yet in its infancy. Sufficient progress has been made, however, to show that many of the economic and ornamental plants that make the hill country in the Eastern tropics of such inestimable value may be grown with success under parallel conditions in the Malay Peninsula.

## Climate.

The writers are indebted to Mr. C. D. Stewart, Superintendent, Meteorological Branch, Survey Department, for the following summary, taken over a period of four years, of the climate of Cameron's Highlands, together with an interpretation of the observations recorded:

## Summary of Meteorological Readings, Tanah Rata, Cameron's Highlands, Pahang.

### Period 1925—1928.

| | Air Temperature in Degrees Fahrenheit. | | | | | | | Rainfall | | Bright Sunshine. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean Max. | Mean Min. | Mean of 1 & 2 | Warmest Day. | Coldest Night. | Coldest Day. | Warmest Night. | Average Month's Fall. | Most in a Day. | Average daily total. |
| | (1) °F | (2) °F | (3) °F | (4) °F | (5) °F | (6) °F | (7) °F | (8) in. | (9) in | (10) hours. |
| January - | 71 | 55 | 63 | 76 | 45 | 64 | 61 | 9.43 | 2.9 | 3.75 |
| February - | 71 | 56 | 63 | 79 | 42 | 64 | 61 | 5.79 | 2.4 | 4.15 |
| March - | 73 | 55 | 64 | 78 | 43 | 64 | 62 | 8.11 | 2.5 | 4.75 |
| April - | 73 | 57 | 65 | 79 | 50 | 68 | 68 | 13.41 | 2.3 | 4.09 |
| May - | 74 | 57 | 66 | 78 | 51 | 68 | 62 | 8.68 | 2.6 | 4.77 |
| June - | 73 | 55 | 64 | 78 | 49 | 64 | 62 | 6.37 | 3.4 | 5.00 |
| July - | 73 | 55 | 64 | 77 | 45 | 68 | 61 | 4.66 | 1.9 | 5.32 |
| August - | 72 | 56 | 64 | 77 | 43 | 66 | 61 | 4.85 | 3.0 | 4.82 |
| September - | 72 | 56 | 64 | 76 | 50 | 66 | 62 | 12.46 | 3.7 | 3.94 |
| October - | 71 | 57 | 64 | 76 | 51 | 58 | 60 | 14.26 | 3.3 | 2.86 |
| November - | 71 | 57 | 64 | 76 | 47 | 63 | 62 | 15.19 | 4.2 | 3.20 |
| December - | 70 | 57 | 63 | 75 | 46 | 63 | 61 | 12.98 | 6.3 | 3.10 |
| 12 Months - | 72.0 | 56.0 | 64.0 | 79 | 42 | 58 | 68 | 116.19 | 6.3 | 4.15 |

The table gives the climatological characteristics of Tanah Rata, Cameron's Highlands, in so far as these can be gathered from observations extending over four years. A four year period is not sufficiently long to enable final exhaustive conclusions to be drawn, but nevertheless, the main features of this summary will give a fairly reliable indication of what may ordinarily be expected of the climate of Cameron's Highlands.

The seasonal changes of temperature are small, but are more distinct than any found in the lower lying parts of the Peninsula. The average values of the daily maximum temperature show this most clearly, the lowest occurring from October to February. The average night minimum, on the other hand, is much the same throughout the year; so that while the change in the position

of the sun shows its effect in the case of the maximum day temperature, it appears that night conditions do not change appreciably.

It is necessary, however, to give some attention to the summary of the individual readings, contained in Columns 4 to 7, inclusive. The averages already mentioned tend to smooth out to some extent differences which should not be lost sight of in a consideration of climate. The mean of 47° and 51°, for example, is 49°, the same as the mean of 41° and 57°, but the climatic conditions represented by the mean value of 49° would obviously not be the same in the two cases. This instance is both more simple and more exaggerated than anything to be found in the table, but the principle remains, namely, that in considering average values some attention must be paid to the range of the readings from which an average is obtained. In the July readings for instance, the warmest day and the coolest day, in four years, differed only by 9°, while in October, the warmest and coolest days during the four years had a difference of 18°. It is not possible to say as yet whether there is any regular change in this respect throughout the year, neither is any such generalisation possible regarding the nights. The difference between the warmest and coolest nights in October is only 9° while in February and March it is 19°. It is interesting to note that the coolest night in every month but two has been 50° or below, while 42° and 43° have been recorded on occasion. The warmest night in each month, on the other hand, is over 60° for all months, reaching, in one case only, the high figure of 68°. This temperature must be regarded as exceptional, as the warmest nights seem to keep very even throughout. The coldest night for different months shows wider variations.

Rainfall shows a very well marked seasonal variation with maximum values centring approximately at the times of the change of monsoons. The greatest rainfall in a day is nowhere very striking, the highest being 6.3 inches, which occurred in the exceptionally wet season at the end of December, 1926.

Sunshine is seasonal in the same way as temperature, the longest days' sunshine being experienced in the middle of the year. The rainy periods have their effect, as shown by the somewhat diminished values for April and October as compared with the neighbouring months, but aside from this the succession is hardly broken.

The above remarks are not to be regarded as a critical examination of the climate of Cameron's Highlands. As has already been remarked, some years of further observations are required. The intention of these notes is to indicate how the tables may best be studied and to summarise the principal features of the data already obtained.

## Flora of the Highlands.

Mr. H. N. Ridley, late Director of Gardens, Straits Settlements, made an extensive collection of plants in the locality in the year 1908, but did not proceed further than Gunong Berembun which is at the commencement of the Highlands.

Ridley's paper published in the "Journal of the F.M.S. Museums," Vol. IV, No. 1, December, 1909, describing the journey from Tapah to Lubok Tamang valley adjoining the Sungei Bertam, is of particular interest. A description of the plants collected, containing many new to science, is of considerable value as a guide to the vegetation of the region. Fairly numerous collections have been made since Ridley's visit and several new plants obtained.

When the boundary line of Pahang is reached, on the road to the Highlands, a marked change in the flora occurs, plants showing relationship with Himalayan types of vegetation being seen. These increase in numbers towards the higher ridges. At Tanah Rata and other low-lying areas of land adjoining the Sungei Bertam, the forest is comparatively thin. During certain months of the year, the ground is studded with flowering herbs, the commonest being the Himalayan Violet (*Viola serpens*), the golden balsam (*Impatiens oncidioides*), begonias, and terrestial orchids. As the mountain ridges are climbed the trees become dwarfed, while on the summits the flora is partially xerophytic. The soil as well as the stems and branches of all the shrubs and trees are thickly covered with mosses, ferns and liverworts. To the untrained eye the vegetation of the Highlands is not particularly interesting, being ever-green with a general absence of conspicuous flowering plants. A notable exception is seen on several of the hills in the Highlands area during the early months of the year when *Rhododendron Wrayi* is in flower, with its large masses of pink and white blooms.

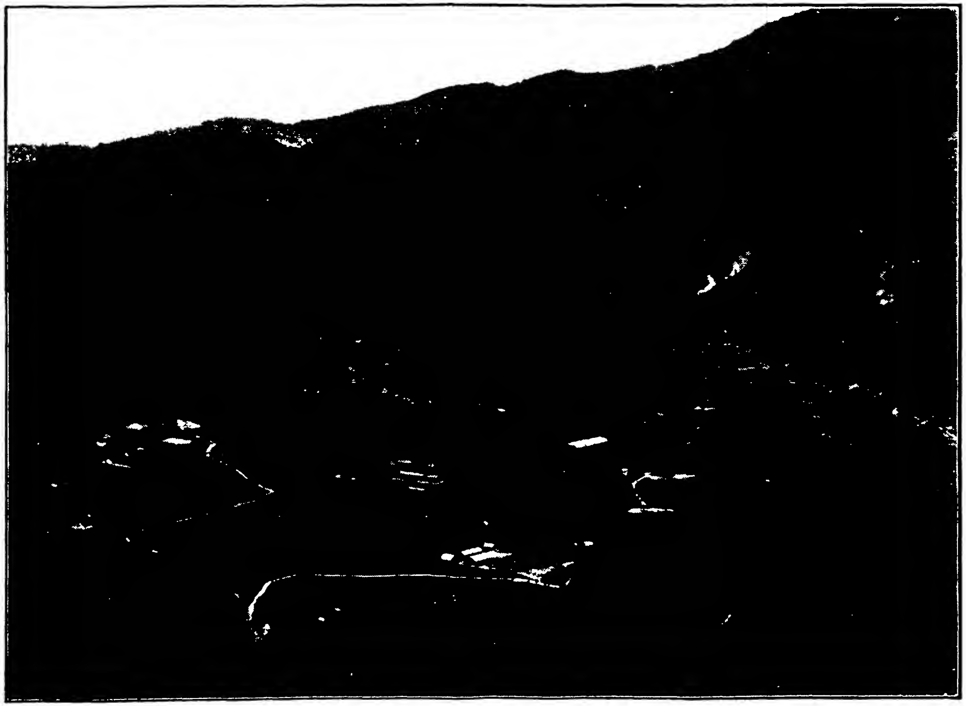
The introduction of a selection of the numerous beautiful trees and flowering plants, that are such a feature of the mountain districts of Java and Ceylon has boundless possibilities. A few of such plants are already established; brief reference is made to these towards the end of this article.

## Situation of the Plantation.

The Experimental Plantation at Tanah Rata is situated at the extreme South-east corner of the Highlands at an elevation of about 4,750 feet. The lower area adjoining the Sungei Bertam is about 4,640 feet, while the highest area so far cleared for planting is approximately 4,800 feet above sea-level.

The greater part of the plantation is sheltered by the surrounding mountain ridges, which include Gunong Berembun (6,036 feet) on the eastern side and Bukit Mentigi (5,120 feet), previously known as Rhododendron Hill, on the western side. Gunong Jasar (5,565 feet) and Gunong Ruil (5,680 feet) are more distant in a north-westerly direction, while Bukit Kumunting (5,074 feet) and Gunong Batu Brinchang (6,665 feet) are towards the north. Gunong Batu Brinchang which marks the limit of the Highlands proper is about 3½ miles from Tanah Rata.

Although the mountain ranges surrounding the plantation afford protection for the various crops under cultivation they have the effect of reducing the amount of sunshine to a considerable extent.



View of Experimental Plantation, Tanah Rata from Bukit Mentigi showing, reading left to right.

Spur No. 1, Old Tea, Coffee arabica and Cinchona, Spur No. 2 Cinchona, Spur No. 3 Young tea.

The total area of the plantation at present is 220 acres including Blocks D1, half of D2, E1, E2, F1, and F2, as shown on the Grid Map prepared by the Survey Department. Each block contains an area of 40 acres.

The opened area is approximately 80 acres comprising mainly Block D1 and E1.

Tanah Rata is situated at latitude 4°28 "North and longitude 101° 23" East.

## Development of the Plantation.

The Assistant Economic Botanist (Mr. W. N. Sands) visited the Highlands in September, 1922, with a party headed by the late Mr. H. C. Robinson, then Director of Museums, Federated Malay States. A report by Mr. Sands on the agricultural possibilities of the Highlands was published as Federal Council Paper No. 6 of 1923. A paper by the same writer appeared in the Malayan Agricultural Journal, Vol. X, page 269, under the heading of "The Agricultural Possibilities of Cameron's Highlands, Pahang." In this paper, reference is made regarding the exploitation of Mr. William Cameron, the eponymous discoverer of the Highlands, who travelled through this part of Pahang in 1885. A report by Mr. V. R. Greenstreet (Assistant Agricultural Chemist) on certain soil samples collected at Lubak Tamang, a valley adjoining the Sungei Bertam (3,600 feet elevation) south of the Highlands, and at Cameron's Highlands was published in the same number of the Malayan Agricultural Journal.

In January, 1925, a visit was made to the Highlands by a party of Agricultural Officers including one of the writers, who took up with him a small quantity of seed of three "jats" of Assam and Manipuri tea, obtained from India for planting at the Experimental Plantation, Serdang, Selangor. Two hundred seeds of each "jat" were sown in prepared nursery beds.

A number of Cinchona seedlings (*Cinchona Ledgeriana* and *C. succirubra*) were transplanted from nursery beds in to larger beds adjoining the area planted with the tea seeds. The Cinchona seed had been taken up to the Highlands on a previous occasion by the Economic Botanist. A report on the introduction of Cinchona appeared in the Annual Report of the Economic Botanist for 1924, published in the Malayan Agricultural Journal, Vol. XIII, page 213.

In March, 1925, the Chief Secretary to Government, Sir George Maxwell, K.B.E., C.M.G., inspected the Highlands with a party of Government Officers. It was then decided that the agricultural activities of the Department should be developed on a larger scale. In December, 1925, Mr. J. P. Wilkins was appointed Superintendent and the direction of the plantation was taken over by the Agricultural Division in January, 1926.

## Labour.

When the plantation was first opened Dyaks were employed as general labourers and Sakais for felling jungle. The former were satisfactory but

proved expensive. The Dyaks were replaced by. Tamils in February, 1926, the latter soon settling down to the conditions obtaining on the Highlands. The Superintendent was able to establish a connection with South India and all labour now employed arrives direct from the Coast. At the present time adult male Tamils are paid at the rate of 65 cents per day. The health of the labourers is particularly good and no difficulty is experienced in maintaining an adequate labour force.

## MAJOR CROPS.

A summary of the cultivations on a large scale at high elevations in neighbouring countries, for example Ceylon, Java and Sumatra, shows that the number of possible major crops is restricted, the most important being tea, Arabian coffee, and cinchona. All these crops have been established at the Experimental Plantation and although they have but recently reached the cropping stage, their growth and behaviour to-date are promising.

### Tea.

It is not proposed in this article to refer in any great detail to the experiments with tea at Tanah Rata, as this has already been published (vide Malayan Agricultural Journal, Vol. XVII No. 1, page 7).

The original area of Assam and Manipuri tea (Dangri, Dhonjan and Rajghur "jats") planted in January, 1926, with one year old seedlings continues to make good growth. This area comprises about 430 bushes, with a planting distance of 4 feet by 4 feet, which gives 2,722 plants per acre.

Plucking operations commenced on the 24th July, 1927, i.e., about 2½ years, from sowing the seed. The bushes were cropped regularly at intervals of 9 to 10 days. The following are the calculated yields per acre of dry tea from this area taking the area of these plots as 1/6th of an acre:—

First plucking year ending 23rd July, 1928 = 470 lbs.
Second plucking year ending 23rd July, 1929 = 525 lbs.

Though the soil of the particular piece of land is rather poor, being very peaty with a sub-strata of quartz, the growth and "flushing" of the bushes have been vigorous.

Owing to the present inaccessibility of the Plantation as far as transport of heavy articles is concerned, it is as yet impossible to instal any machinery, and for this reason it is at present a matter of difficulty to gauge the quality of the tea produced owing to the primitive process employed.

The following reports have been recently received through the courtesy of Messrs Guthrie & Co., Ltd., Kuala Lumpur, who forwarded two samples of hand-made tea from the Experimental Plantation, Cameron's Highlands, to their London Office for report and valuation:

**REPORT BY MESSRS CHARLES HOPE & SON, LONDON, DATED 15TH OCTOBER, 1929**

"*Leaf.*—This Tea has the appearance of a leafy well graded Broken Orange Pekoe with a fair show of good coloured tip and does not contain any very coarse leaf.

*Cup Quality.*—The liquor has the character which is usually associated with very young leaf. It is light in colour of cup and has indications of being somewhat over-fired.

*Infusion.*—This is bright and is the best characteristic of the Tea and rather leads us to suppose that the Tea is well manufactured with the exception of being over-fired, but that the green leaf is lacking in essential oil.

The tea would sell on this Market in competition with low grown Northern Indian Tea or Java, mostly for its appearance, its cup quality being unattractive.

To-day's value, the market being on a very low basis, is about 11d.

| *Description.* | *Character.* | *Value.* |
|---|---|---|
| Hand made Broken Orange Pekoe. | | per lb. |
| *Leaf.*—Black, even, well made, fair tip. | | 1/3d |
| *Infused Leaf.*— Fairly bright. | | |
| *Liquor.*—Light, brisk, little high fired." | | |

A commencement was made during the latter part of 1927 to extend the area under tea with seedlings raised on the plantation. A total area of 30 acres is now planted comprising various Assam and Manipuri "Jats". The following varieties have been planted:—

*Dangri.*—A pure Manipuri jat, derived from the original Manipuri stock. It has a dark leaf, is very hardy and bushes quickly.

*Dhonjan.*—A pure Assam variety derived from indigenous Assam stock. It has a large dark green leaf, flushes freely and is comparatively hardy.

*Betjan.*—A pure Assam stock, having a large leaf of medium colour but not so large as some of the light-leaved varieties. It is a heavy yielder and noted for its large "fat tips."

*Rajghur.*—A cross between a pure Assam and a pure Manipuri plant. It is a high yielder and very hardy.

Seed of these "jats" were obtained from the Dangri and Dhonjan Tea Seed Co. Ltd., Dibrugarh, Upper Assam.

*Charali Manipuri.*—A pure Manipuri plant having a dark leaf.

*Charali Assam.*—A pure Assam variety having broad leaves of medium colour.

*Amulguri.*—A pure indigenous dark leaf Assam plant.

*Dutea Manipuri.*—A pure Manipuri variety.

*Muttapong Manipuri.*—A dark leaf Manipuri plant.

These seeds were obtained from Messrs. E. S. Stewart & Co., Calcutta.

These varieties have been planted on what is known as Spur C in Block E1. This area is divided into one acre plots. The land is hilly and steep in

places, but characteristic in this respect of the majority of the land in the Highlands area. The young bushes are making good growth and show promise of forming a fine field of tea.

The area is planted with trees as shade and wind breaks including the following: *Acacia decurrens, Grevillea robusta, Albizzia moluccana* and *Dalbergia assamica.* The following leguminous trees have been introduced for use as green manures: *Erythrina lithosperma* (thornless dadap), *Gliricidia maculata,* and "Boga medeloa" *Tephrosia candida.* Cover plants have been established on certain of the plots, the most promising or these at present being *Dolichos Hosei* and *Indigofera endecaphylla,* the former is likely, however, to be troublesome owing to its climbing habit. The whole area is divided into one acre plots which are subject to various forms of cultivation, i.e., terracing and silt pits.

Seed of Manipuri tea Rajghur, sufficient to plant one acre, has recently been obtained from tea seed bearers at Ginting Simpah (2,000 feet elevation) in Pahang.

Also 3,000 tea seeds have been obtained from Escot Estate, Tanjong Malim, from seed bearers raised from seed originally obtained from an up-country estate in Ceylon. This tea, when established, will be of particular interest as representing second generation tea in Malaya.

In November, 1929, ½ maund of seed of each of the undermentioned "jats" was forwarded by the General Export Company, Calcutta, for trial on the Highlands. These varieties are described as follows:—

*Taikong.*—A dark leaf pure Assam jat of a hardy type producing a vigorous plant.

*Markong.*—A dark leaf pure Manipuri jat, hardy and vigorous.

It will be seen, therefore, that a comprehensive collection of tea "jats" is established at the Experimental Plantation. The majority of the plants are as yet quite young being about 2 years old from seed, but the behaviour and growth of the bushes is encouraging.

An area of 4½ acres comprising Assam and Manipuri "jats" raised from seed planted early in 1927 has reached the cropping stage and plucking was recently commenced.

## Rates on land for Tea Cultivation.

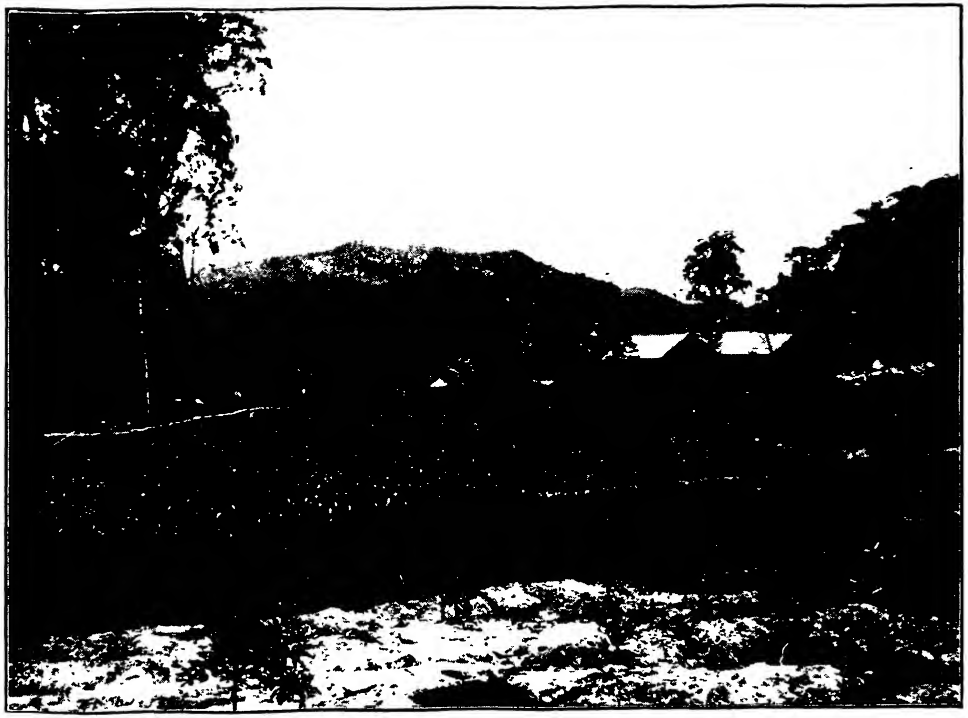
The rates proposed by Government for grants of land for the cultivation of tea are as follows:—

Premium dependent on the situation of the land with regard to roads—no definite figure has been laid down.

Rent one dollar per acre per annum for the first six years and thereafter four dollars per acre per annum.

## Importation of Tea Seeds.

The importation of tea seeds and plants into the Federated Malay States and Straits Settlements is governed by F.M.S. Gazette Notification 2829 of



View of Nursery, Experimental Plantation, Tanah Rata, Citrus in foreground, tea seedlings, Gunong Jasar behind,

26.4.29 and S.S. Gazette Notification 767 of 26.4.29, respectively. These notifications result in "Living plants or parts of plants including seeds of tea" being included in Schedule A of the Plant Importation Rules under the Pests Enactment of the Federated Malay States and Pest Ordinance of the Straits Settlements.

Briefly, this means that those who wish to import tea seeds into Malaya have to observe the following regulations.—

(*a*) Written permission of the Director of Agriculture or, in his absence of the Chief Field Officer, must be obtained before the seeds are despatched from the country of origin.

(*b*) Seeds imported must enter by one of the Entry Ports, namely Port Swettenham in the Federated Malay States; Singapore and Penang in the Straits Settlements.

(*c*) Each consignment of seeds must be accompanied by a Certificate of Freedom from diseases or pests issued by a duly authorised official in the form given in Schedule B of the Plant Importation Rules.

(*d*) The seeds will be inspected upon arrival at an entry port by an Inspector who has power to deliver to the importer or subject the consignment to whatever treatment he may deem necessary for the destruction of any pest.

Coffee is also included in Schedule A of the Plant Importation Rules.

## Cinchona.

When the Experimental Plantation was taken over by the Agricultural Division in January 1926, a number of seedlings of both *Cinchona Ledgeriana* and *C. succirubra* had been established by the Economic Botanist from seed obtained from Java in June, 1924. The majority of these plants, however, were washed away by the severe flooding of Sungei Bertam which occurred during December, 1926. A few plants survived and were planted out on terraced land. A number of trees are growing fairly well, but on the whole they show uneven growth.

A further quantity of seed, consisting of 25 grammes of *C. Ledgeriana* and 25 grammes of *C. succirubra* was received from Java in October, 1926. On the 18th November, half of the seed of each variety were sown in carefully prepared seed beds. Germination commenced on the 9th December, 1926, and ended in March, 1927. A large number of seeds germinated and were transplanted into nursery beds at the end of March, 1927.

These seedlings were again transplanted in September, 1927, being spaced 6 inches apart in nursery beds, which were lightly shaded with bracken. Owing to the dampness on the Highlands, considerable care is needed in keeping the young plants in a vigorous growing condition. Cinchona is a very difficult

plant to establish and requires careful handling in both the seed and nursery beds in order to develop into robust seedlings which will eventually withstand transplanting in the field.

The balance of 12½ grammes of seed of each variety was sown in May, 1927. Germination commenced within a month from sowing and a further supply of seedlings were ready for transplanting in nursery beds at the beginning of October, 1927.

In October and November, 1929, a large number of seedlings were planted in the field. These seedlings were planted 4 feet apart on terraces, the vertical interval between the terraces being about 7 feet.

An experiment was also commenced with the object to test the effect of shade on the growth of cinchona and two acres of jungle were cleared of all undergrowth and small trees for this purpose.

At the present time there are approximately 5 acres of cinchona planted in the field and 2 acres planted in thinned out jungle making a total area of about 7 acres or roughly 3½ acres of each variety.

Although there are isolated patches in both Ledgeriana and succirubra plots in which the trees show good growth, poor patches are found throughout the planted area, which gives it an uneven appearance. It should be stated, however, that general unevenness of growth is characteristic of Cinchona cultivation, consequently due allowance must be made for this particular factor in judging the standard of growth on the Highlands. The poor growth is especially noticeable where the young trees are on peaty soil. On the higher parts of the area where the peat layer diminishes and a deep clay-loam soil commences the trees have made considerably better growth.

A sample of bark of *C. Ledgeriana* submitted for analysis to the Government Quinologist, Mungpo, India, elicited the following report dated the 10th May, 1929:—

"The samples of Bark from the Federated Malay States were not large enough to test separately. In fact not large enough for a very accurate analysis even when all mixed together.

But the result I have obtained is 6.6 per cent. Quinine Sulphate and no appreciable amount of Cinchonidine, a very nice bark."

The Superintendent of Cinchona Cultivation in Bengal, in forwarding the report made the following comments: "It will be seen that the samples could not be analysed separately through insufficiency of material, but the average content is very good indeed". Larger samples have recently been forwarded to India for examination and report. Particulars of the trees from which the samples were taken are as follows:—

1. Seed germinated in December, 1926.
2. Planted in the Field in November, 1927.
3. Samples collected March, 1929.
4. Height of bushes about 6 feet.

Cinchona Succirubra Growing at Tanah Rata.

Cinchona Ledgeriana Growing at Tanah Rata.

Further seed was sown in April, 1929, in specially constructed seed beds as employed in the Cinchona Plantations in Northern India. At the present time there are a large number of seedlings of both species in nursery beds that will be ready to plant in the field during the year.

The following extract from a report entitled "Cinchona in the Empire" by Mr. J. M. Cowan, lately officiating Director, Botanical Survey of India and Superintendent of Cinchona Cultivation, Bengal, is of interest. The report is issued by the Empire Forestry Association, London, in the form of a reprint from the Empire Forestry Journal Vol. 8 No. 1, 1929.

"The ecological factors necessary for the successful growth of *Cinchona Ledgeriana,* so as to yield a satisfactory return of bark and alkaloid, may be summarised as follows. In India it has been found that suitable conditions are only present where there is evergreen forest on granitic or volcanic rock formations. The soil must be rich, porous, well-drained and with moderate to steep slopes. The least water-logging is fatal to the plants.

As to climate, *Cinchona Ledgeriana* will stand neither great heat nor frost; the ideal temperature may be taken as about 75° F., with a mean minimum of 60° F. and a mean maximum of about 85° F. A hot sun with no shade is unfavourable. The limits of rainfall are roughly from 75 to 180 ins. per annum. Even 200 ins. may not be excessive on a well-drained soil, but a much lower rainfall on a stiff clay would prove disastrous. The upper limit in altitude is about 5,000 feet and the lower limit about 1,500 or 1,000 feet. Cinchona grown at low elevations usually has, however, a poor percentage of alkaloids. Although the above particulars indicate the type of land that may be suitable for cinchona, it must be remembered that, even in a locality where all conditions appear to be favourable, it is advisable to plant experimentally before attempting operations on a large scale."

The writers consider that the preliminary results obtained with the cultivation of Cinchona on the Highlands are distinctly encouraging and that undoubtedly suitable areas exist where its extended planting might be carried out with success.

## Arabian Coffee.

A small parcel of 1½ lbs. of "Kents" Arabian Coffee seed was received from the Department of Agriculture, Mysore, in March, 1927. The parcel contained 3,750 seeds or approximately 2,500 seeds to the pound. A small area was planted during September, 1929 with the seedlings raised. A further consignment of quarter bushel of Kents' Arabica Coffee seed was received from Mysore and 26,900 seeds were sown in nursery beds on the 20th February, 1928. Germination commenced in April and finished in May, producing 25,500 seedlings, which represents approximately 94 per cent. germination within a period of about 3 months. The seedlings were planted out in the field during the early part of May, 1928.

A total area of 6 acres is planted with this crop. The bushes appear very healthy and are growing vigorously. The older bushes, planted during September, 1927, commenced flowering in March, 1929 and now show the first crop of berries.

## Cardamoms.

A small supply of seeds was received from the Department of Agriculture, Ceylon, during March, 1928. Seed of both the Mysore and Malabar varieties were obtained. Germination commenced two months later. The plants made excellent growth in the nursery beds. The area under this crop has recently been extended to two acres; a piece of ravine land cleared of undergrowth only being planted with suckers obtained from the original plants in the nursery beds. Judging from the behaviour of these plants and the fact that Zingberaceous plants abound in the Highlands, there appears little doubt that the cultivation of cardamoms will be attended with success. The elevation at which the cardamoms have been planted, namely 4,750 feet, is considered rather high for this crop.

## MINOR CROPS.

Numerous economic plants are under trial on a small scale both in the nurseries and in the field.

A number of fodder grasses introduced from the Experimental Plantation, Serdang, have proved successful on the Highlands and the following details may be of interest.—

Guinea Grass, *Panicum maximum*.—This grass thrives remarkably well at all elevations leading up to the Highlands and growth is equally good at 4,750 feet elevation as on the plains. Small areas are planted at Jor, at Renglet, Lubok Tamang and Tanah Rata for feeding pack mules. This valuable fodder grass should prove useful for feeding all kinds of stock on the Highlands.

Carpet Grass, *Axonopus compressus*.—This grass thrives at Tanah Rata and appears to grow more vigorously than on the plains. It should prove useful as a grazing fodder. When kept scythed it may be employed as a turf in gardens.

Australian Blue Couch, *Digitaria didactyla*.—This species shows remarkably vigorous growth and thrives considerably better on the Highlands than it does on the plains. It is proving useful for grazing and turfing of slopes.

Other grasses which have been successfully established on the plantation include Bermuda grass (*Cynodon dactylon*), Citronella grass (*Cymbopogon citratus*), Lemon grass (*C. nardus*) and Vetiver grass (*Vetiveria zizanioides*). A fine leaved grass originally raised from seed obtained from England has become established. It is of tufted habit and appears to be suitable as a grazing fodder. This grass so far has not been observed to flower, hence the difficulty in naming the species.

## Tuba Root.

A small plot of "tuba puteh" (*Derris elliptica*) has made very healthy growth and proves quite amenable to the climate of the Highlands. Plants 20 months old yield an average of one pound of root (wet weight). In view of the value of this plant for insecticidal purposes, the knowledge that it will thrive at such a high elevation is of some importance.

## Fruits.

The climate and elevation of the Highlands is not suitable for the successful cultivation of the majority of temperate fruits.

The following fruits have been introduced and have so far shown good results:—

*Strawberry*.—An area of about half an acre has been established with a variety originally introduced from the Philippine Islands. This variety appears well suited to local conditions and produces fair crops of fruit of good flavour, though small in size as compared with produce as grown in Europe. Other varieties, raised from seed obtained from England, include Improved Red Alpine, Large Red Alpine and Royal Sovereign. These varieties so far have fruited poorly, the tendency of the plants being to produce numerous suckers.

*Rhubarb*.—Considerable success is being obtained with rhubarb raised from seed. Plants under a year old are producing at a single picking over 4 lbs. of sizeable sticks of good flavour. It is evident that this garden crop will thrive well on the Highlands.

*Tree Tomato*.—This salad fruit has been successfully established. The egg-shaped fruit, which is produced in great abundance, may be kept for several weeks after plucking without affecting its quality for edible purposes. The average weight of a ripe fruit is about 2 ozs. and a single tree will produce hundreds of fruits in the course of a year. It is in season almost throughout the year.

*Passion Fruit*.—This climber (*Passiflora edulis*) produces its oval purple fruit in great abundance.

The Mountain Papaya, *Carica candamarcensis*, commonly grown in hill gardens in Ceylon, has been introduced and is making good growth. The green fruit may be used for making into jam and preserves.

Other fruits which have been planted include lemon, orange, grape fruit, pomelo, Cape gooseberry, guava and persimmon. The majority of the fruits are growing well but so far the trees are of insufficient size to produce fruit.

The wild raspberry (*Rubus rosaefolius*) occurs in quantity in opened land. It is probable that the cultivated forms of raspberries will succeed, though an attempt to establish them from seed failed owing to the seeds not germinating.

## Vegetables.

The following vegetables have been grown from time to time with excellent result:—lettuce, radish, green pea, beans, beetroot, onion, carrots, potatoes, Jerusalem artichoke, cabbage, Kohl-rabi and tomatoes. The cultivation of vegetables has, however, sometimes been attended with disappointing results owing probably to the acid nature of the newly opened land and the heavy rains during the wet seasons. Insect pests, notably the Cut Worm (*Prodenia litura*), have proved a considerable difficulty in vegetable cultivation, especially during the early stages of growth. It should be noted that the present small area of land opened, surrounded by extensive areas of jungle, probably results in the vegetable crops being more subject to the depredations of insects.

It has been found that continuous and heavy rains at critical stages of the vegetables' growth proves ruinous.

It is evident that good hill vegetables may be raised where the land is systematically cultivated and manured. It is anticipated that with the development of the Highlands, supplies of vegetables in quantity will become available for sale in the large towns in the Peninsula.

## Ornamental Plants.

A large number of the flowers, shrubs and ornamental trees that succeed at Fraser's Hill, Pahang, and Maxwell's Hill, Perak, have been introduced.

The following plants are mentioned as of particular interest:—

Flowering cherries raised from seed obtained from the Southern Shan States. These trees have made remarkably rapid growth but so far have not flowered.

Bulbous plants from South Africa; several species, notably *Agapanthus umballatus, Crinum Moorei,* Watsonias, Moraeas and Montbretias, are growing and flowering well. The Arum lily was introduced from Newara Eliya, Ceylon, early in 1929.

Roses are a conspicuous success; bushes raised from cuttings obtained locally and imported plants have both done well.

Ornamental trees from Australia are thriving particularly well. These include the following species:—

*Eucalyptus globulus* (Blue Gum), *E. citriodora, Acacia Bayleyiana, A. decurrens.*

*Cryptomeria japonica, C. knightiana, Grevillea robusta, Cupressus macrocarpa* and *Casuarina* spp. are also thriving.

Conifers show promise of being a great success on the Highlands and there is considerable scope in the introduction of such trees suitable for this elevation. The Asahan Pine (*Pinus Merkusii*), a pleasing feature of the hills in Sumatra and Java, has been established. This evergreen pine grows well at

Ginting Simpah (2,000 feet elevation) in Pahang, where comparatively young trees have reached a height of 20 feet and more and now produce seeds.

Mention has already been made of the fact that indigenous Rhododendrons are a feature on the higher hills of the Highlands. The soil being acid and in many places peaty it is most probable that many species of this beautiful genus may be introduced with success. *Rhododendron arboreum*, a fine species from the Ceylon hills, and numerous others from Sikkim, should be established as soon as opportunity occurs.

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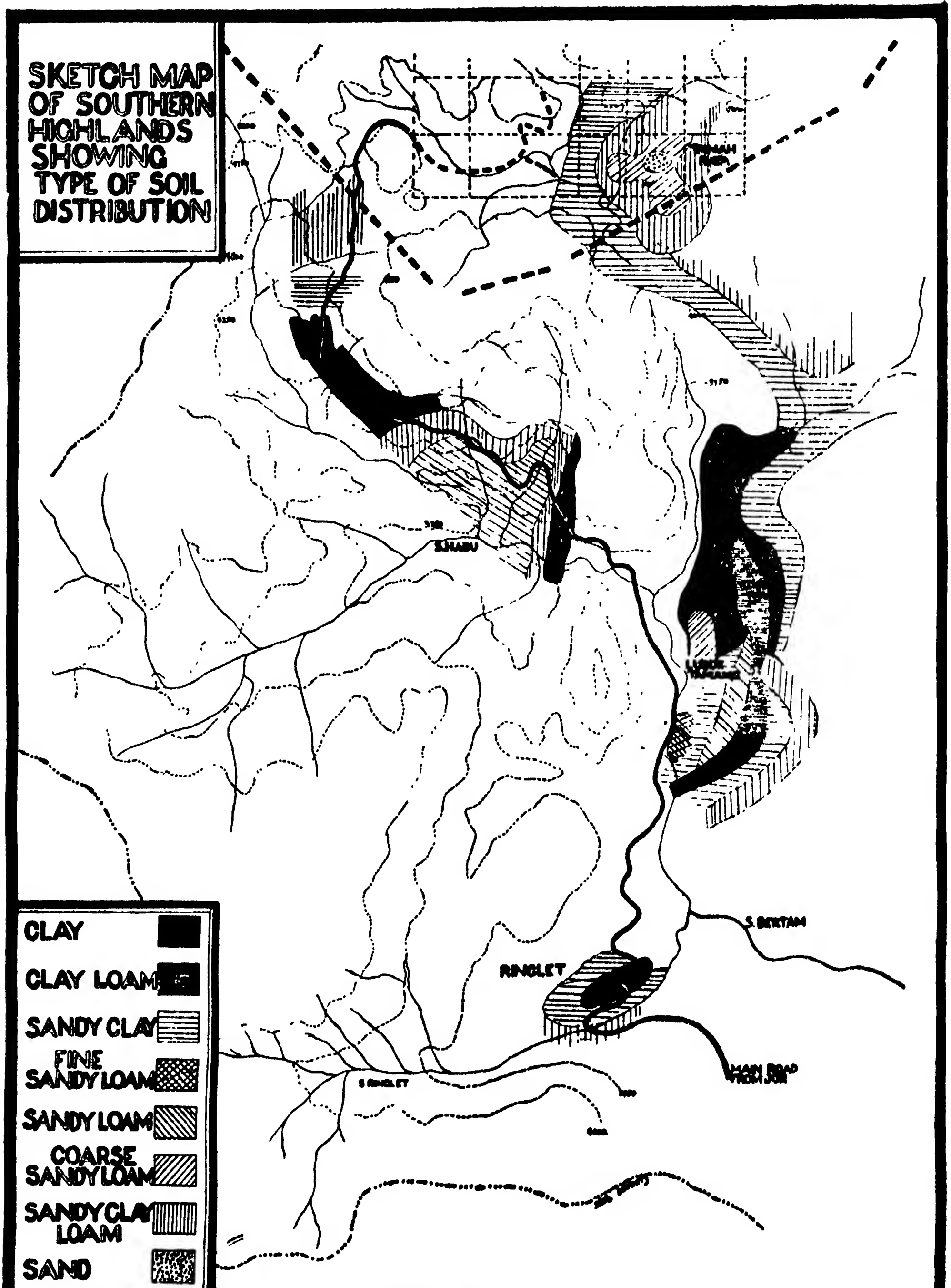
SKETCH MAP OF SOUTHERN HIGHLANDS SHOWING TYPE OF SOIL DISTRIBUTION
CLAY
CLAY LOAM
SANDY CLAY
FINE SANDY LOAM
SANDY LOAM
COARSE SANDY LOAM
SANDY CLAY LOAM
SAND
S. HABU
S. BERTAM
RINGLET
S. RINGLET

# THE SOILS AT CAMERON'S HIGHLANDS.

By

J. H. Dennett.

*Assistant Chemist,*

*Division of Soils & Plant Physiology.*

*In the article which follows it is necessary to use a certain number of semi-technical terms in regard to soil (though they are terms evolved by the layman long before the study of the soil became a science) and it therefore does not seem out of place to say a few words about soil in general.*

*Everyone is aware that soil is formed by the mechanical and chemical decomposition of rocks due to the action of weather. As it weathers the quartz which the rock contains is set free and gives rise to a large extent to the familiar large grained constituent of the soil—sand, while part of the quartz on the other hand remains combined with the alumina of the rock and gives rise to that other familiar soil constituent—clay, which is of microscopic fineness.*

*The "texture" or "lightness" or "heaviness" of a soil will depend to a large extent on the relative proportions of the sand or clay particles. The sand particles may not of necessity consist only of quartz but also of small undecomposed fragments of rock within certain limits of size.*

*The study of the soil soon shewed that it was possible, by an arbitrary division of the particles of which it is composed, to classify the terms which had been in use by the farmer for centuries (i.e. loam, clay, sand etc.) to correspond to soils within definite limits of mechanical composition.*

*The particles of which the soil is composed are divided according to size into stones, gravel, coarse sand, fine sand, silt and clay. It is obvious that any soil may consist of any mixture of these and three main groups have been made (1) sandy soils, (2) loamy soils (3) clay soils. These groups can be further divided as follows:—*

## 1.—Sandy soils.

| | | |
|---|---|---|
| (a) **Sands** *Clay and silt practically absent.* | i. | *Coarse sand.* |
| | ii. | *Sand.* |
| | iii. | *Fine sand.* |
| (b) **Loamy sands** *15—20% Clay and silt together.* | iv. | *Loamy coarse sand.* |
| | v. | *Loamy sand.* |
| | vi. | *Loamy fine sand.* |

## 2.—Loamy soils.

| | | |
|---|---|---|
| (c) **Sandy loams** *20—50% Silt and clay together.* | vii. | *Course sandy loam.* |
| | viii. | *Sandy loam.* |
| | ix. | *Fine sandy loam.* |
| (d) **Loams** *Over 50% Silt and clay together.* | x. | *Loam.* |
| | xi. | *Silt loam.* |

## 3.—Clay soils.

| | | |
|---|---|---|
| (e) **Clay loams** *20—30% Clay.* | xii. | *Sandy clay loam.* |
| | xiii. | *Clay loam.* |
| | xiv. | *Silty clay loam.* |
| (f) **Clays** *Over 30% clay.* | xv. | *Sandy clay.* |
| | xvi. | *Clay.* |
| | xvii. | *Silty clay.* |

*The above table is of course to some extent arbitrary but it provides a means of giving a soil of known composition a definite name. It may further be reckoned that for general purposes subgroups (a), (b) and (c) are lighter soils and subgroups (d), (e) and (f) are heavier soils.*

*In addition to the mechanical composition of the soil a knowledge of its chemical constituents is essential.*

*One important factor is humus which is formed by the decay of leaves etc. By it we mean the organic material which the soil contains in a form which is likely to be readily assimilated by the plant, and, roughly speaking, if there is a good quantity of dead plant material overlying or mixed up with the upper layer of the soil, one might expect a fair quantity of humus.*

*From the humus and dead plant remains generally the plant derives much of its nitrogen.*

*Certain mineral constituents of the soil are as essential to plant life as they are to human life, namely potash, phosphorus and lime and to a lesser extent magnesium, so that a knowledge of the quantities of these, particularly the first three, which the soil contains is of importance.*

## The Highlands.

A vast part of the soils of Cameron's Highlands are of granite origin as will be obvious to the most casual observer during a tour of the area. As granite contains a high percentage of quartz it would be expected that soils formed therefrom would contain a good percentage of sand.

The soils of the Highlands are comparatively young and it would appear possible that in some cases the soils are of a sedimentary nature, that it so say, they have been removed from their original sites by the action of rain.

The average depth of useful soils throughout the Highlands seems to be about 3 feet when either parent rock or a very stony soil is reached. Many places do occur where the depth is considerably deeper, but on the other hand, rock may occur within a foot of the surface and it is considered that three feet represents a good average.

Soils have been found to range from coarse sands to friable clays, light soils however predominate.

From casual observation along roads and bridle paths it seems almost as though the soil varied every few yards, but the variation is less real than apparent and is rather due to what might be described as different states of tilth and/or the presence of greater or lesser quantities of humus.

Changes of course occur, but not so rapidly as that, and the soils on the whole roughly follow the contours.

The following description is given of individual areas.

## Tanah Rata 4700 feet.

This area is of special interest as it is contiguous to the town sites and it is here that the Experimental Plantation of the Department of Agriculture is situated.

The soil of slopes to the south west where young tea seems to be thriving well varies from a sandy clay loam to a coarse sandy loam and is of a good yellowish red colour with a fair amount of humus. The soils all become more open in texture with increasing depth, thus ensuring the good drainage that tea needs. They are all on the acid side of neutrality thus fulfilling another requirement of tea.

Contiguous to these slopes, on the hill on which the Agricultural Superintendent's Bungalow is situated, were found patches of pure quartz gravel and sand covered by thin layers of clay and peat. A small area of tea on this land seemed to be doing very well and is bearing excellently, but it cannot be considered that such land is of any great general agriculture value. Coffee and Cinchona certainly do not thrive on it and whether the tea will do so well when the roots get down to the barren quartz is open to doubt, though it may still be able to draw sufficient nourishment from the acid peat-clay layer. Similar areas have been found further north particularly at Brinchang, on the slopes of the Gunong, but in any case these outcrops are very small, appear only intermittantly and have not been encountered further south or east of Tanah Rata. Visually, quartz sand outcrops appear similar to the white clay which sometimes occurs with the weathering of granite. They can, however, be immediately differentiated by feel.

The majority of the soil at Tanah Rata, however, varies as stated above, from sandy clay loam to a coarse sandy loam and seems admirably suited to tea. Along the bridle path from Tanah Rata to Kuala Habu the soil is of much the same texture and is very definitely of an open nature.

## Lubok Tamang.

This area has been previously reported on by Mr. Sands, Assistant Economic Botanist, in the Malayan Agricultural Journal, Volume X, 1922. It consists of a semivalley area chiefly on the east side of the Bertam stretching roughly from the junction of the Bertam and the Habu to the junction of the Bertam and the Renglet. The land for the most part is gently sloping to flat going to steeper hills to the west and east.

The soils of this area have been thoroughly prospected, having first been reported on as probably suitable for tea as far back as 1914. They shew a wide range of variation and appear to extend in merging belts in a north and south direction and roughly following the configuration of the land. The variations found are clay, clay loam, sandy clay, sandy clay loam, sandy loam and coarse sandy loam so that most of the soils of the above table are represented. The clay soils are quite friable as will be appreciated from the tables which follow (soils R319 & R330) as they contain quite a fair proportion of sand. Following what is to be expected as a rule in the Highlands, the soils of the area become lighter with increasing depth, making for good drainage. Down the valley of the Renglet the soils vary in much the same way as at Lubok Tamang and the area although not very extensive, generally seems to be promising.

## Habu Valley and Road Trace to Tanah Rata.

The soils around the road trace shew much the same variations as Lubok Tamang. At the 35½ mile the soil is a friable clay while along the Habu Valley itself there is a very promising sandy loam with a good quantity of humus. This type of soil stretches to beyond the 37th mile. At the 38th mile a further area of reddish brown friable clay occurs very similar in texture to that at the 35½ mile. By the 39th mile the soil changes to a sandy clay not so rich in humus and mineral plant food as those previously encountered, while by the 40th mile the soil becomes a sandy clay loam rather poor chemically. Generally speaking, the land on either side of the road trace is steep, and cultivable areas consist of recurrent spurs capable of being terraced. The Habu Valley area though small, appears promising.

From the 40th mile back to Tanah Rata the land is more or less flat and passes through the future village area. There is much peat and white clay in evidence.

North west of Tanah Rata the soil again appears to be decidedly variable with a number of small quartz outcrops.

## Outer Highlands.

An expedition was made from the outer Eastern Highlands from Kuala Habu towards Sungei Boh plantation following the valley of the Ulam.

For about the first mile from the Kuala the soil consists of a sandy clay very like the granite soils encountered in Selangor. From this point on, the soil shewed the same variations as the other areas. At about two miles from the Habu a very interesting area of almost flat park-like land was met with possessing a clay top soil going to a sandy clay loam below. About a mile and a half further on, a similar flat area was encountered having a clay loam soil rich in humus. Beyond this until the Ginting was reached, the soil was a fair sandy loam going to coarse sandy loam below, very similar to that occurring on the tea slopes of Tanah Rata. Soil samples taken on Sungei Boh itself were found to be of the same nature.

## General.

Although soils of all textures were encountered during the survey, yet the predominating type is a light one, chiefly sandy loams. The soils are all on the acid side, which is what tea requires. It may be considered as practically impossible that an alkaline lime soil will be found in Malaya at anything approaching the height of Cameron's Highlands.

On the whole, the soils are decidedly richer in mineral plant foods and nitrogen than are the corresponding lowland soils and they seem very suitable for tea and garden produce, though for the latter, despite their comparative richness, manuring will certainly be necessary.

## Java and Assam.

It is of interest to compare the soil of Cameron's Highlands with those of Java and Assam tea soils.

In Java tea is grown on soils varying from coarse sand (only about 6 per cent. of clay and silt) through various intermediate soils to a very heavy clay containing up to 80 per cent. of clay and 10 per cent. of silt.

In Assam the heaviest soils, which are found in the Sibsagar district, contain about 50 per cent. of clay and are of a decidedly sticky nature, while the lightest soils are very similar to the lightest tea soils of Java.

It should be pointed out that the Java soils are largely of volcanic origin and that the sand fractions in consequence are likely to be richer in plant food than the Malayan Hill soils of granite origin.

The best Java soils contain about 1 per cent. of nitrogen with an average of about 0.35 per cent. while the corresponding figures for Assam are 0.2 per cent. and 0.1 per cent. The organic matter, which is about the same for both countries, is about 10 per cent.

The potash content of Java soils is high while the phosphorus content is lower than the Assam figures which vary from about 0.05 to 0.15 per cent; in both countries the total lime varies from about 0.1 to 1.0 per cent.

Both the Java and Assam soils are slightly acid having an average pH value of 5.5 (pH 7.0 means a neutral soil, a lower figure than this indicates a soil on the acid side, a higher figure a soil on the alkaline side of neutrality).

Although tea is grown in Java on soils as nearly neutral as pH 6.8 soils having a pH of 6 or over are considered bad for tea in Assam.

It is of great interest to compare the figures mentioned above with those obtained with the soils of Cameron's Highlands.

### Approximate Limits of Mechanical Composition.

| Soil | Gravel | Coarse sand | Fine sand | Silt | Clay |
|---|---|---|---|---|---|
| Java Tea (most sandy) ... | 47 | 37 | 4 | 2 | 6 |
| Java Tea (most clayey) ... | — | 1 | 4 | 14 | 82 |
| Assam Tea (most sandy) ... | 10 | 40 | 38 | 4 | 8 |
| Assam Tea (most clayey) ... | — | 15 | 25 | 10 | 50 |
| Cameron's Highlands (most sandy) ... | 50 | 37 | 5 | 3 | 5 |
| Cameron's Highlands (most clayey) ... | 22 | 23 | 5 | 4 | 46 |

### Approximate Averages of Mineral food stuffs etc.

| Soil | pH | Potash% | Phosphorus% | Lime% | Nitrogen% | Organic Matter% |
|---|---|---|---|---|---|---|
| Java Tea ... | 5.5 | circa 1.0 | 0.01—0.07 | 0.1—0.5 | 0.35 | 10.0 |
| Assam Tea ... | 5.5 | 0.1—0.5 | 0.05—0.15 | 0.1—0.4 | 0.10 | 10.0 |
| Cameron's Highlands ... | 5.0 | 0.1—0.3 | 0.03—0.1 | 0.02—0.08 | 0.2 | 12.0 |

It would seem from the above figures that Cameron's Highlands soils compare quite favourably with the tea soils of Java and Assam. The lime content of the two latter is somewhat more than that found locally, but as pointed out previously, tea is not a lime loving shrub. The difference in the average pH value is negligible.

In both India and Java, the practice of artificial manuring is resorted to, and experience has shewn that what is chiefly required is nitrogenous and phosphatic manures, additional potash having very little effect.

Without in any way suggesting it as a manurial programme the following figures are of interest as indicating replacement requirements in Java.

Manures are applied at so much per bush. The following quantities have been recommended by the Theeproefstation of Java: 10 grams (1/3 oz.) sulphate of ammonia per bush with or without the same amount of superphosphate, or about 30 grams (1 oz.) urea or 75 to 100 (3—4 oz.) of fish guano. This works out for sulphate of ammonia at about 70 lbs. per acre per annum.

In conclusion it may be pointed out, in connection with the statement above, that manuring would very definitely have to be resorted to for market gardening, that the quantities of manures required for this purpose would be greatly in excess of that required for a permanent crop like tea. The ideal for market gardening without doubt is cattle manure, but it is unlikely that there would ever be sufficient of such manure in the highlands for large scale vegetable production, and it will therefore generally be necessary to apply a full chemical treatment to get the best results.

## SELECTED TYPICAL SOIL ANALYSIS.

| Ref. No. Locality. | Clay. | Silt. | Fine sand. | Coarse sand. | Gravel. | Stones. | pH. | Potash as $K_2O$. | Phosphorus as $P_2O_5$. | Lime as CaO. | Nitrogen. | Loss on Ignition. | Type. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. Lubok Tamang. | | | | | | | | | | | | | |
| R314T | 32 | 11 | 5 | 22 | 20 | | | .450 | .050 | .032 | | | Sandy clay |
| Sa | 32 | 12 | 13 | 24 | 13 | | | | | | | | do |
| Sb | 32 | 12 | 14 | 26 | 13 | | | .426 | .034 | .025 | | | do |
| R315T | 18 | 17 | 17 | 19 | 21 | 8 | | | | | .218 | | Sandy loam |
| Sa | 23 | 16 | 13 | 21 | 15 | 4 | | | | | .082 | | Sandy clay loam |
| Sb | 21 | 17 | 13 | 19 | 20 | 7 | | | | | .062 | | Sandy clay loam |
| R316T | 23 | 25 | 15 | 20 | 16 | | | .570 | .037 | .032 | | | Clay loam |
| Sa | 18 | 18 | 20 | 21 | 22 | | | .440 | .041 | .025 | | | Sandy loam |
| Sb | 12 | 17 | 19 | 21 | 29 | | | .440 | .030 | .025 | | | Sandy loam |
| R319T | 31 | 12 | 14 | 18 | 14 | 1 | | | | | | | |
| Sa | 33 | 8 | 10 | 18 | 11 | | | | | | .179 | | Clay |
| Sb | 35 | 12 | 11 | 20 | 11 | 3 | | | | | .117 | | Clay |
| | | | | | | | | | | | .067 | | Clay |
| R330T | 44 | 2 | 5 | 20 | 19 | | | | | | | | |
| Sa | 49 | 2 | 5 | 17 | 26 | 3 | | | | | .291 | | Clay |
| Sb | 44 | 10 | 6 | 22 | 17 | 2 | | | | | .134 | | Clay |
| | | | | | | | | | | | .079 | | Clay |
| B. Road Trace. | | | | | | | | | | | | | |
| R609T | 59 | 5 | 8 | 11 | 4 | | 44 | 0.040 | .1065 | .063 | .3320 | 23 | Clay |
| Sa | 52 | 14 | 9 | 14 | 10 | | 4.7 | 0.470 | .0716 | .050 | .0196 | 15 | Clay |
| Sb | 49 | 7 | 11 | 17 | 16 | 22 | 4.8 | 0.067 | .0561 | .049 | .2380 | 10 | Clay |

SELECTED TYPICAL SOIL ANALYSIS.—(*Cont.*).

| Ref. No. Locality. | Clay. | Silt. | Fine sand. | Coarse sand. | Gravel. | Stones. | pH. | Potash as $K_2O$ | Phosphorus as $P_2O_5$ | Lime as CaO. | Nitrogen. | Loss on Ignition. | Type. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B. Road Trace. | | | | | | | | | | | | | |
| R610T | 20 | 26 | 16 | 18 | 8 | | 4.1 | 0.094 | .0694 | .073 | .0784 | 27 | Sandy loam |
| Sa | 12 | 30 | 32 | 17 | 7 | | 4.4 | 0.070 | .0654 | .050 | .1120 | 13 | Sandy loam |
| Sb | 4 | 12 | 34 | 15 | 13 | 2.5 | 5.4 | 0.084 | .0286 | .055 | .2012 | 22 | Loamy sand |
| R613T | 32 | 19 | 11 | 12 | 26 | 4 | 3.9 | 0.084 | .0260 | .028 | .2940 | 13 | Sandy clay |
| Sa | 26 | 28 | 18 | 11 | 17 | 5.6 | 4.2 | 0.097 | .0402 | .025 | .2800 | 14 | Sandy clay loam |
| Sb | 28 | 24 | 17 | 11 | 18 | 9.4 | 4.4 | 0.150 | .0048 | .028 | .2744 | 10 | Sandy clay loom |
| C. Tanah Rata. | | | | | | | | | | | | | |
| R620T | 25 | 14 | 8 | 28 | 25 | 3.3 | 3.9 | 0.108 | .0328 | .051 | .2488 | 18 | Sandy clay loam |
| S | 32 | 20 | 9 | 20 | 15.5 | | 4.5 | 0.154 | .0363 | .071 | .1624 | 15.5 | Clay |
| R622T | 13 | 9 | 6 | 28 | 41 | 3.5 | 4.8 | 0.060 | .0381 | .078 | .2240 | 18 | Coarse sandy loam |
| Sa | 5 | 8 | 4 | 19 | 60 | 4.1 | 5.2 | 0.033 | .0716 | .053 | .1932 | 2 | Loamy coarse sand |
| Sb | | | | | | | 5.0 | | | | | | |
| R337T | 13 | 9 | 7 | 33 | 26 | 4 | | | | | | | Coarse sandy loam |
| Sa | 6 | 13 | 10 | 48 | 25 | 2 | | | | | | | Loamy coarse sand |
| Sb | 3 | 3 | 8 | 46 | 39 | 7 | | | | | | | Coarse sand |
| D. Outer Highlands | | | | | | | | | | | | | |
| R615T | 31 | 14 | 10 | 20 | 10 | | 4.0 | | .1065 | .028 | | 40 | Sandy loam |
| Sa | 11 | 14 | 28 | 25 | 9 | | 6.1 | | .0631 | .066 | .0140 | 27 | Sandy loam |
| Sb | 5 | 12 | 17 | 42 | 10 | | 5.8 | 0.130 | | .056 | | 25 | Coarse sandy loam |

SELECTED TYPICAL SOIL ANALYSIS.—(*Cont.*).

| Ref. No. Locality. | Clay. | Silt. | Fine sand. | Coarse sand. | Gravel. | Stones. | pH. | Potash as $K_2O$. | Phosphorus as $P_2O_5$. | Lime as CaO. | Nitrogen. | Loss on Ignition. | Type. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R617T | 26 | 27 | 19 | 14 | 11 | | 4.2 | 0.361 | .0716 | .043 | .3584 | 14 | Clay loam |
| S | 29 | 31 | 25 | 14 | 4 | | 4.6 | 0.725 | .0458 | .068 | .1344 | 10 | Clay loam |
| D. Outer Highlands | 30 | 16 | 6 | 19 | 27 | | 4.3 | 0.233 | .0572 | .050 | .3304 | 12 | Sandy clay |
| R619T | 29 | 16 | 9 | 16 | 30 | 2.3 | 4.6 | 0.195 | .0521 | .028 | .2464 | 9 | Sandy clay |
| Sa | 26 | 10 | 6 | 20 | 35 | 4.1 | 4.9 | 0.247 | .0272 | .069 | | 6 | Sandy clay loam |
| Sb | | | | | | | | | | | | | |
| E. Brinchang. | 5 | 5 | 5 | 34 | 44 | 5 | | | | | | | Coarse sand |
| R332T | 6 | 9 | 12 | 42 | 29 | 2 | | | | | | | Coarse sand |
| Sa | 6 | 16 | 25 | 35 | 16 | 1 | | | | | | | Sand |
| Sb | | | | | | | | | | | | | |
| R333T | 21 | 15 | 11 | 32 | 13 | 1 | | .400 | .021 | .034 | | | Sandy clay loam |
| Sa | 32 | 15 | 11 | 23 | 9 | | | .520 | .056 | .031 | | | Sandy clay |
| Sb | 32 | 16 | 13 | 18 | 6 | | | .530 | .040 | .034 | | | Sandy clay |

# IMPROVEMENT OF THE COCONUT CROP BY SELECTION.

*Being a lecture delivered at Bagan Datoh Club on 2nd May, 1929.*

BY

H. W. JACK,
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## Introductory.

Though coconut cultivation covers an area of some six million acres and has been a stable industry in the tropics for many years, the question of improving coconut crops has hardly been touched.

The significance of this statement is all the more surprising when due consideration is given to the vastness of the industry, to the great length of the economic life of the coconut palm when grown under fair average conditions and to the fact that individual palms show such a wide range of variation in fruiting ability. Moreover, in temperate regions, the consumption of coconut oil for confectionery and in the soap and other manufacturing industries has increased enormously within the past two decades. For instance, in 1910 coconut oil was hardly known in the United States of America. Furthermore, the future development of the coconut industry would appear to be assured since the steady increase in oriental populations situated within or near coconut growing regions has produced an increasing demand for fresh nuts for culinary purposes, thus counterbalancing to some extent the areas which are being planted annually by large exporters. The striking increase in the utilization of the products of the coconut palm leads to the anticipation that not only will their present uses expand, but that new uses may be found for them in the future, so that the potentialities of the industry are difficult to gauge. Hence it is all the more astonishing that so little attention should have been paid to investigating methods for improving this very important crop.

## Improvement.

The improvement of the coconut crop may be considered from several aspects. For *areas which have already been planted*, the main line of improvement would suggest the amelioration of the environment by whatever means may be found to be feasible. Thus, soil conditions may be capable of very great improvement by better cultivation, by growing cover crops or crops suitable for green manuring; by the application of artificial manures, by improved drainage, by irrigation, by reducing acidity or by other means, but in adopting any of these methods or combinations of them, scientific advice should first be sought and

the cost of adopting the selected method must be balanced against the possible crop returns. It may even prove remunerative to destroy unprofitable palms and replace them by seedlings derived from known heavy producing palms which have been growing under very similar environmental conditions. Also the possibilities of increasing crops by root pruning or by wound effects are deserving of investigation. Then again, there is the question of eliminating or controlling pests and diseases which are known to affect the crops adversely and regarding which there are yet many unsolved problems.

The application of any of the above methods of improvement is still comparatively novel, and reliable data, on which their relative merits may be gauged, are difficult, if not impossible to obtain, so that there is unlimited scope for research along these lines.

*As regards future plantings,* apart from the various methods which may be found economically successful in ameliorating the environment of the palms in new areas, the effect of careful selection of seed nuts from tested palms should prove attractive, since, as already stated, individual palms growing under apparently similar conditions show a wide range of producing ability.

As the title indicates, this lecture will be confined to the consideration of this method of improvement.

The term "*selection*" as regards seed coconuts is misapplied to a very large extent at present, because the methods of selecting them are far from scientific and are rarely based on a thorough examination of the individual tree. The commonest method of selection is that of purchasing seed nuts from a well established estate which is known to produce a fair quantity of copra per acre. This method is tolerably sound in the absence of reliable tree data as long as the trees from which the nuts are derived are growing in similar soil, subjected to similar water conditions to those existing on the area where it is desired to establish a new plantation, but it merely ensures the production of trees of average utility; in other words it is not selection at all. An improvement on this method is that of examining the trees in the field and marking as parents those individual trees which show desirable characters or which closely approximate to an approved type, and using only the fruits from those palms as seed nuts for new plantings. This method, if thoroughly performed, should result in a more uniform plantation than the more casual method which is usually adopted, though complete uniformity cannot be obtained because trees which appear very much alike, differ not only constitutionally, but seedlings from the same parent tree may be found to vary to an extent as yet undetermined, on account of the cross pollination which takes place to a very large extent between "tall" palms as compared with "dwarfs".

## Variation.

Variation is common to all crops, annual and perennial and in coconut cultivation, *variation* is well known to occur in many characters. Some of

these such as colour, size and shape of fruit, are readily apparent, while other characters can only be revealed by careful investigations covering an extended period. In the latter category can be included seasonal variation in cropping, variation in root formation, variation in female flower production, and in the production of mature fruits per palm, variation in size and shape of nut, in thickness of meat, in oil content of the meat, in the rate of germination of seed nuts from different palms of the same variety, in disease resistance and in other characters. Some of these variable characters are obviously affected by cultivation, but despite all cultivation, variation will persist.

The *chief variable characters* of economic importance are, however, (a) the amount of copra produced by individual palms and (b) the percentage of oil in the copra derived from individual palms.

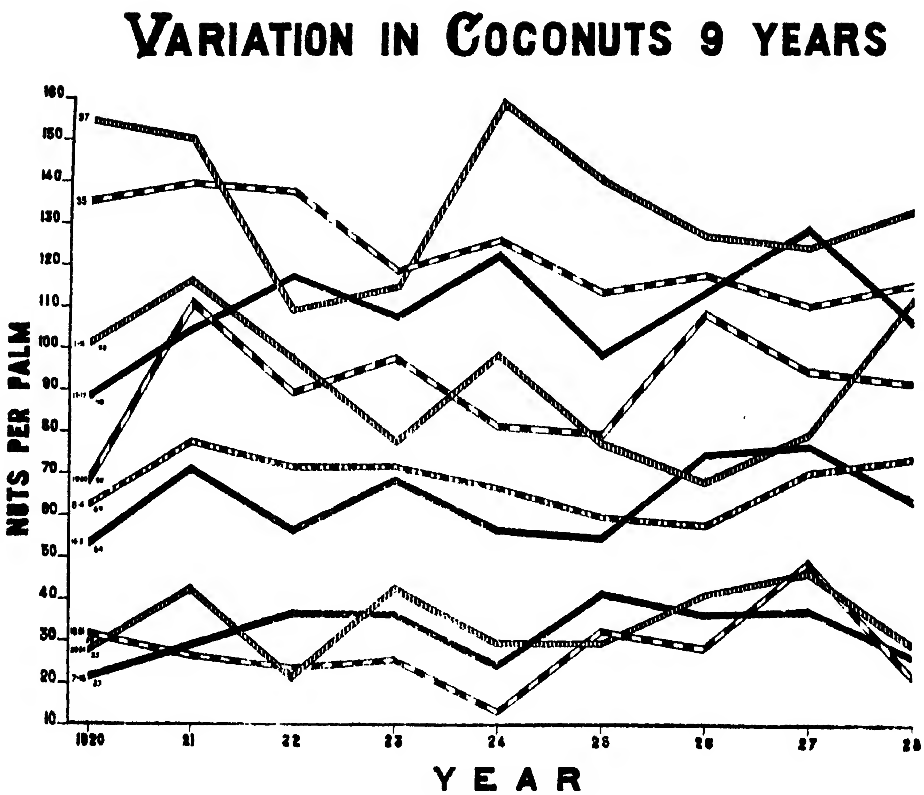
## Variation in Copra production per Palm.

With regard to the variability in the amount of copra produced by individual palms, this is the most important factor affecting the planter, because the chief marketable product of the coconut is copra. Little is known concerning the methods of purchasing copra in Europe, and though sometimes one hears of copra being bought according to oil content, I think it may safely be said that copra is judged and priced mainly by the appearance of the commodity and without any reference to intrinsic values based on analyses (c.f. rubber). The Department of Agriculture is investigating the methods adopted in the copra market in Europe, but at the present time, all that is known is that in the local market, copra is valued solely by its general appearance; hence in order to meet market requirements, the main concern of the planter is to produce large quantities of copra of good appearance. In other words, quantity not intrinsic quality is the essential factor; therefore variation in the amount of copra produced by individual palms is of first importance in any effort to improve the coconut industry from the producer's aspect.

An investigation of this character (yield of copra per palm) involves a study of the fruit producing ability of different trees and indicates the advantage of maintaining a cropping register for individual palms. The maintenance of such a register over a large area would not prove a practical task but offers no particular difficulty in selected areas of 40 or even 50 acres.

Such a register would not be a sure index of the copra producing ability of a palm, since due consideration must be given to the size and shape of the nuts and to the thickness of the copra, still it should afford a reliable indication of the extent to which variation occurs and greatly assist in selecting good producing palms. Amongst the causes of variation in cropping in a mixed population, due weight must be given to the importance of cultural operations and in particular, to general environmental conditions which are likely to differ somewhat for every palm even where such conditions appear identical, but the hereditary characteristics of the palm must not be overlooked because, despite

DIAGRAM I.



VARIATION IN COCONUTS 9 YEARS
NUTS PER PALM
YEAR
1920
21
22
23
24
25
26
27
28

the variable factors of environment, each palm retains its own individuality as long as conditions favour a fair degree of development. In confirmation of this statement, it has been found, through the systematic records on which these notes are constructed, that in a mixed population of tall palms such as is found on any coconut estate, good producing palms on the average remain proportionately good yielders from year to year, while poor yielders continue to produce poorly.

An examination of Diagram No. 1 will illustrate the constancy of fruit yielding ability of average, good and high producing palms. This diagram shows that the annual fruit production of each palm is constant over a period of nine years, within the limits of seasonal variation. (15% of the mean, as shown in the Malayan Agricultural Journal, Vol. 16. page 379).

Thus the annual yields of fruits in each case fluctuate above and below the mean yield over the entire period. As was anticipated, the annual fluctuation about the mean is insignificant in the case of the average producing palms. It is more apparent with palms of medium utility while for high producing palms the annual variation is marked. Of course, the records on which the diagram is based do not cover a sufficiently long period to render the figures absolutely reliable, but their comparative uniformity over a period of 9 years would certainly indicate that the ability to fruit, apart from seasonal variation, is an hereditary character.

An extensive study of the variation in fruiting ability of individual palms was initiated in June 1920 on a local estate of good productive capacity as may be gauged from the fact that the field in question produced, over the past 8 years, an average of *11.35* pikuls of copra per acre.

The rainfall on the estate averages around 95 inches per annum and is well distributed throughout the year except that July is usually fairly dry.

A block which originally carried 480 palms growing in twenty consecutive rows, each row containing twenty-four palms, was chosen as being fairly representative of the conditions on the estate, and each palm was labelled with its row and palm number. Of these palms, 4 which had died and 5 which were young supplies are omitted so that the records deal with 471 palms.

In June 1920, the average age of the palms was just 10 years; originally the palms were planted 30 x 30 feet apart. The estate is well drained, having a water table some 4-5 feet below the surface of the soil. The block under experiment is surrounded on all sides by a drain four feet deep and six feet wide at the top and intersected by two subsidiary drains four-and-a-half feet wide by three feet deep which divide the block into four equal-sized areas. One subsidiary drain runs between rows 10 and 11 and the second cuts it at right angles between the 12th and 13th palms of each row.

The soil consists of a rather stiff alluvial clay loam somewhat on the heavy side for coconut cultivation, but to all appearances very uniform in texture throughout the block. Primarily, the estate was clean-weeded but midway through the experiment a cover crop of *Centrosema plumieri* was sown and slowly

established itself affording a fair cover crop. This cover was removed in the sixth year of the experiment when the area was cultivated to a depth of 8-10 inches.

On this block the ripe fruits were cut every 5-6 weeks by means of a curved knife attached to the end of a long bamboo as most of the fruit bunches were 30-40 feet from the ground. *Expert* pickers always performed this operation and piled the fruits from each palm at its base ready to be counted.

The results of each picking have been carefully preserved and summarised and compiled into a frequency Table (Table I) from which mathematical calculations can be made in order to show at a glance what conclusions may be drawn from the results.

The results can also be portrayed graphically in what is known as a frequency curve,* which represents diagrammatically and with mathematical accuracy the results of the observations derived from a large mass of figures, which in themselves would convey little tangible information.

The Frequency Curve visualises at a glance, the results of many measurements of any particular character—in this case number of nuts produced per palm per annum.

Table I and Diagram II (frequency curve from Table I) show the range of variation (5 to 115 nuts) the mean and the group frequencies of the average production of nuts per palm per annum over a continuous period of eight years on the block under observation e.g. in Diagram II, if horizontal and vertical lines are drawn from the highest peak of the curve to the side line (frequencies) and the bottom line (groups) respectively, it will be seen that 88 of the palms in the block each produce an average of 55 nuts per annum over a period of 8 years.

The figures in this table prove the land to be of good average productive capacity since the average number of fruits obtained per palm per annum is 59 which is usually regarded as a satisfactory figure, being some 13 nuts better than the average for large estates.

Moreover, the nuts are of good average size since the average annual yield of copra per acre over the area during the period was 11.35 pikuls (1510 lbs.) and the actual average number of nuts per acre per annum for the same period was 2,783 so that 245 nuts were sufficient to produce one pikul (133 lbs.) of copra, which is considered a fair average.

In comparing different variable characters or the same characters in different individuals, biologists use a term called the co-efficient of variability. This is merely a convenient method of comparing different nuts or individuals and is found by expressing the variation of any character as a percentage of the mean for that character. The variable character in this instance is number of nuts per palm per annum.

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* A frequency curve is a means of expressing results in which the figures obtained are classified in numerical groups and the number of results which fall in each group are plotted **seriatim.**

TABLE I.

| Groups. | F. | % of total No. of Palms. | F × G. | d. | d.[2] | Fd[2] |
|---|---|---|---|---|---|---|
| 5[1] | 1[2] | .2 | 5 | 54[3] | 2916 | 2916 |
| 15 | 11 | 2 | 165 | 44 | 1936 | 21296 |
| 25 | 34 | 7 | 850 | 34 | 1156 | 39304 |
| 35 | 44 | 9 | 1540 | 24 | 576 | 25344 |
| 45 | 65 | 14 | 2925 | 14 | 196 | 12740 |
| 55 | 88 | 19 | 4840 | 4 | 16 | 1408 |
| 65 | 83 | 18 | 5395 | 6 | 36 | 2988 |
| 75 | 71 | 15 | 5325 | 16 | 256 | 18176 |
| 85 | 35 | 7 | 2975 | 26 | 676 | 23660 |
| 95 | 32 | 7 | 3040 | 36 | 1296 | 41472 |
| 105 | 5 | 1 | 525 | 46 | 2116 | 10580 |
| 115 | 2 | .4 | 230 | 56 | 3136 | 6272 |
| | N = 471 | Σ F × G = 27815 | | | Σ Fd² = 186156 | |

Mean = $\Sigma$ F × G ÷ N = 27815 ÷ 471 = 59.09, say 59. nuts per palms per annum
= 2783 nuts per ac. per annum.

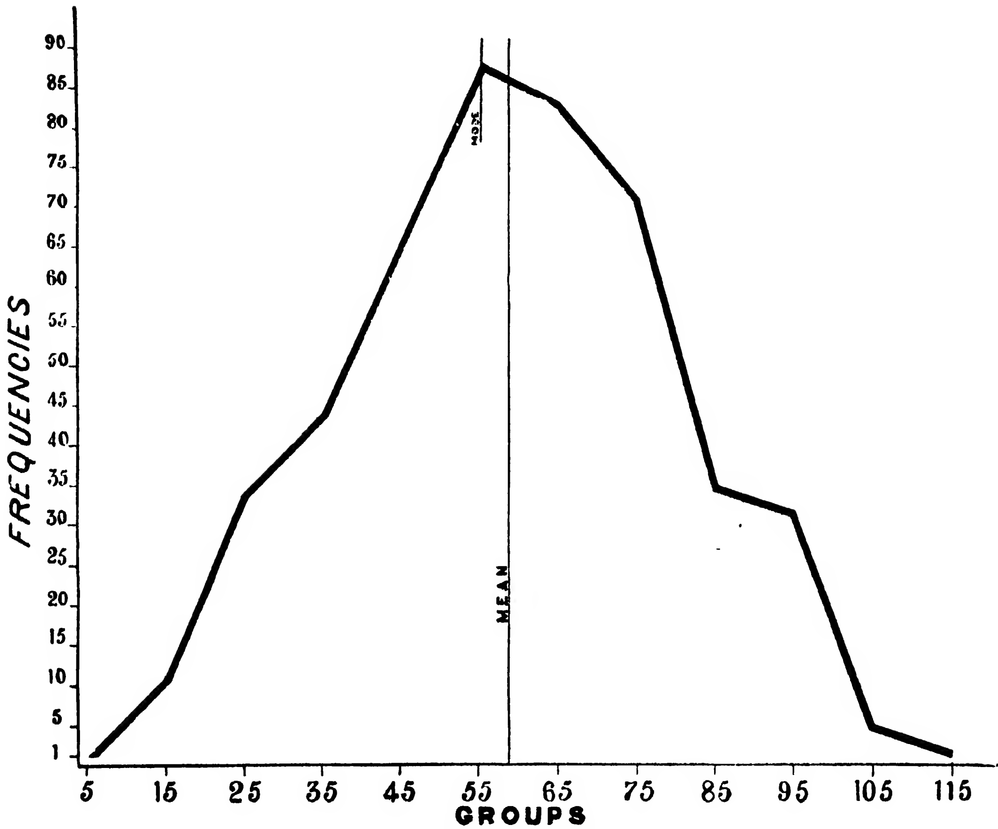
1. Nuts per palm per annum to the nearest group figure.
2. No. of palms per group.
3. Deviation group figure from the average or mean yield of nuts per palm per annum.

$$\text{Standard Deviation} = \sqrt{\frac{\Sigma F.d^2}{N}} = \sqrt{\frac{186156}{471}} = \sqrt{395.24} = 19.88$$

$$\text{Coefficient of variability} = \frac{\text{S.D.} \times 100}{N} = \frac{19.88 \times 100}{59} = 33.6949$$

say 34%.

DIAGRAM II.




Frequency Curve showing range of variation in Average Yield of Fruit per Palm per annum in a Group of 471 Palms over a continuous period of Eight Years.

The co-efficient of variability shows that if any palm on the experimental area is chosen at random, its average fruit yielding capacity is likely to vary from the mean productive capacity of all the palms in that area by as much as 34% of the mean value.

For the sake of simplicity and in order to explain the term "co-efficient of variability" let it be assumed that the mean production per palm per annum is 60 nuts instead of 59, the actual mean. Then, the chances are even, that any palm chosen at random on the block in question will have an average annual productive capacity of ± 34% of 60 nuts, that is, it will fall within a group containing all those palms having an annual production of from 40 nuts up to 80 nuts, or, in other words, any palm picked at random is unlikely to vary from the mean of *all* the palms of the entire population by more than 20 nuts per annum. Table I also shows that, if an average yield of 40 nuts per palm per annum is regarded as the lowest profitable production figure for estates, (some estates reckon on 30—35 nuts as sufficient to show a profit) then 93 palms or 19% of the palms on the block are not profitable under ordinary conditions, though it might, of course, be possible to improve them by special cultivation and manuring or by other means. This Table further shows that 74 palms or 15.7% of the total number have annually averaged 80 nuts per palm or more and have produced 6,770 nuts or 24.3% of the entire crop. Similarly 39 palms or 8.3% of the population (that is all those with an average annual yield of 90 nuts and upwards) have produced 3,795 nuts or 13.7% of the total crop.

Bearing in mind that the yielding ability of all the palms on the block appears to be constant and that the range of variation in production of individual palms is so wide, it would seem possible to improve vastly the total productive capacity of the area by eliminating all those palms which fruited unprofitably or even all those which yielded annually less than the average and by replacing them by the progeny of palms tested for high yield of copra. The planting of seedlings amongst already mature palms hardly gives the young plants a fair chance of attaining their best development, since the conditions of free growth are seriously hampered, particularly as regards sunlight and root competition, still the substitution of seedlings from high yielding parents is likely to prove economic in comparatively young plantations. On the area in question, work along these lines is in progress since all the unprofitable palms have been cut out and have already been replaced by seedlings from selected parent palms.

As already described, the experimental area is fairly typical of good average coastal coconut land in Malaya, so that it may confidently be assumed that a similar degree of variation would be found on other profitable coconut areas where alluvial coastal conditions prevail. This wide and constant range of variation, revealed by figures dealing with records over an eight-year period, strongly emphasises the economic possibilities of scientific selection of high yielding types. Such a selection involves not only the number of fruits which each

palm is capable of producing but due consideration must be given to the average size of the nuts produced by each palm and to their copra content, because it is quite conceivable that a palm which normally only produces 70 large fruits per annum may yield more copra than a palm of which the average annual fruit production is 90 or 100 or even more smaller nuts.

Not only is a wide range of variation apparent in the number of fruits produced per palm annually, but the size of the nuts varies greatly on different palms, thus affecting the amount of copra which the fruit of each palm is capable of producing.

TABLE II.

| Palm No. | No. of nuts used in determination. | Average copra produced per nut in grams. | Average annual fruit production per palm over 8 years. | Average annual copra production per palm in lbs. |
|---|---|---|---|---|
| 1 (a) | 34 | 254 | 55 | 31 |
| 3 | 30 | 270 | 90 | 54 |
| 12 | 27 | 264 | 111 | 65 |
| 3 (a) | 35 | 215 | 76 | 36 |
| 10 | 26 | 236 | 105 | 55 |
| 2 (a) | 32 | 275 | 53 | 32 |
| 13 | 25 | 206 | 157 | 72 |
| 17 | 25 | 245 | 99 | 54 |
| 1 | 18 | 180 | 83 | 33 |
| 100 | 15 | 283 | 113 | 71 |
| 47 | 19 | 195 | 20 | 9 |
| 43 | 18 | 290 | 29 | 19 |
| 38 | 10 | 302 | 126 | 85 |

Within fairly narrow limits it has been found that the size of nut produced by any palm is fairly constant provided that fair average growing conditions are maintained and allowing for seasonal variation. Also the mean size of nut of different tall palms (as judged by the weight of meat) varies (up to as much as 70%) as can be seen from column 3 of Table II which covers several pickings with most of the palms. Though the size of nut from individual palms

is fairly constant, a seasonal variation of about 15% is frequently found between the size of nut at different pickings from the same palm.

Thus, as can be seen from col. 5 of Table II, the amount of copra produced per palm annually is variable according to the number of fruits produced per annum and to the size of the nuts, and since the average palm produces about 30 lbs of copra per annum, the value of a plantation in which all the palms average 50 or 60 lbs. of copra per annum or more is obvious.

Unfortunately, as yet we know little of the genetics or hereditary characters of the ordinary tall coconut palm except that many palms are hybrid in their constitution since cross pollination takes place to a very large extent, but experiments with the object of investigating the genetics of the coconut are well under way at the Klang Coconut Selection Experiment Station and should produce a fund of useful information in due course. As regards the dwarf coconut palm, the position is already much more satisfactory because by observation and by experiment we know that the three races of dwarf, the green, red and yellow, which are fairly common locally, are genetically comparatively pure, since the rate of production of flowers ensures a high percentage of self pollination. Thus, if the planting of dwarf palms is restricted to one type only, it will be found that the rate of growth, the period between planting and maturity, and the general fruiting characters of the plantation will be comparatively uniform where conditions are tolerably regular—whereas, with tall palms, growth and fruiting characters vary considerably so that tall plantations show much more irregularity as compared with fields planted with a single type of dwarf. In this connection it may be pointed out that the green race of dwarfs is hardier than either the red or the yellow race and produces a larger nut which gives a better copra and is, in fact, a good commercial proposition. The green dwarf palm is capable of producing, under good average conditions, not less than 20 lbs. of copra per annum with some 90 palms planted to the acre, whereas the average tall palm produces about 30 lbs. of copra per annum and an acre can carry only 50 to 55 palms, so that the proportionate yields per acre under good average conditions would be as 6:5 in favour of the green dwarf palm That is, a plantation of green dwarf is capable of producing 20% more copra than the same area of "Talls" under fair conditions.

Should it be possible to obtain a pure Race of the tall coconut which would breed true to the character or characters for high yield, as the dwarfs appear to do, then the tall type would prove much superior, because many tall palms can produce annually an average of 85 nuts or more.

There is every hope of this possibility being achieved, but the results of observations on tall palms take so long to materialise, that the necessary proofs of the probability are not yet available.

In the meantime, a search is being made for some vegetative character or characters which can be correlated with high yield so that genetically high yielding palms may be recognised at an earlier date in their life period than is possible at present in order that selection may proceed at a much more rapid

pace. As is well known, the propagation of coconuts is only possible through the seed, there is no short cut like budding as in the case of rubber, so that the establishment of some growth character which can be correlated to yield at any early age in the life of the palm is of much importance.

Assuming the average palm to produce 60 nuts per annum (the actual average is lower) and that each nut produces 250 grammes of copra, then the average palm should yield approximately ($250 \times 60 \div 450 =$) 33 lbs. of copra annually.

Judging from the facts of variation which have been cited, it should be possible on new plantations to raise considerably the average yield per palm by the rigid selection of high yielding palms for the supply of seednuts for future plantings. Seven of the palms included in Table II show calculated yield values exceeding 50 lbs. of copra per annum while four of them even exceed 65 lbs. per annum and the 10 acre plot from which the data were collected carries many more such palms, so that the selection of palms as seed bearers is not a difficult matter. A plantation planted entirely with palms capable of producing 50 lbs. of copra per annum would be equivalent to an increased production per acre of approximately 50 % and even this increase might conceivably be exceeded.

While such an increase is possible, under practical conditions and considering the hybrid nature of many of the seed nuts, it is more likely that first generation increases would be of the order 25-35% but even this increase would be highly desirable.

Improvement of the coconut crop is a slow process, yet in view of the long economic life of the palm, selection, in existing plantations, of the best producing palms for seed purposes should prove profitable and attractive.

# A REVIEW OF F.M.S. STATISTICS RELATING TO RUBBER PRODUCTION.

By

J. Gordon-Carrie,

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The year 1929 is the first for which almost complete statistics relating to rubber are available. Six years of Restriction of Exports of Rubber had, by the artificial conditions imposed upon the production of rubber, brought about many contradictory results. It had also, very unfortunately, given rise to certain misconceptions, not the least of which in importance was that regarding the productivity—and especially the relative productivity—of the big estates of 100 acres or more, and the smaller estates and holdings of less than 100 acres in area.

No doubt, to use the phrase coined by General Dawes, a major part of that misconception might be traced as due to the—quite futile—attempts to "apply a common yard stick" alike to the big estates and to the small holdings. Really they are not directly comparable.

During restriction, the maximum assessed allowance per acre given to any small holding was less than half that given to the highest assessed of the big estates. A similar, though not so great, difference in the average assessments per acre of large estates and smaller holdings existed in favour of the former.

It is, therefore, not difficult to understand why—after six years of that influence to distort their vision—prophets of the production to be expected during the first year of free production, seriously underestimated the potential production of Malaya's small holdings.

For the Federated Malay States, almost complete statistics relating to rubber have been made available by the Rubber Statistics Department. Tables of figures are, however, "dry bones" to most people. For that reason an attempt is made in this article, by the aid of graphs and charts which illustrate it, to present in a more attractive, and more easily understandable form some of the information which can be derived from the published statistics relating to rubber.

Chart A illustrates the areas planted with rubber in the Federated Malay States during the years 1923—1928. The chief point of interest is the great increase in the planting programme of big estates which was caused by the "boom" values of rubber during 1925 and 1926.

Charts B, C, and D are all illustrative of production figures: but in order to gain full information from them it is needful first to study somewhat carefully the following notes. With reference to Chart B it must be emphasised that while half of the columns thereon illustrate the actual monthly production of all estates of 100 acres or more, the adjacent columns show NOT the monthly

production of the smaller holdings but the amount sold to dealers monthly by the owners of such holdings.

In general, the owners of holdings less than 100 acres in area do not hold rubber off the market but sell as they produce. There are, however, times when for a few days the sales are retarded: and when such times occur at the end of a month the total sales in that month are lessened by an amount which, almost always, goes to swell the total sold in the next month.

For that reason the total production by holdings of less than 100 acres in any one month cannot be deduced directly from the statistics published monthly. These give, by the use of a simple calculation, the amount of the total sales during the month of rubber by such holdings.

If, however, the amounts sold monthly are averaged over three or four months, the figure so arrived at gives the average rate of production during that period. Thus, by the simple process of taking averages over periods of that duration, each such period progressing by one month, it is possible to arrive at estimates of monthly production which are almost exact. (The margin of error is within an extremely small percentage.)

Another factor of some importance is that crops harvested monthly by big estates—which are declared, and which Chart B illustrates—are, for statistical purposes, open to the objection that apart form seasonal variations they are also subject to the influence of their differing time components: e.g., April's crops are harvested in 30 days, as are June's, while the crops in the mid-month of May are garnered in 31 days.

It is, therefore, essential that any charts which can be regarded as correctly indicative of comparative yields shall illustrate monthly yields in terms of yield per day in each month. A further and useful development of that principle is to express such day-monthly yields in terms of equivalent yield per acre per annum.

Chart C illustrates the declared and calculated yields of large estates and smaller holdings expressed in terms of tons per day in each month. It is interesting to note from this Chart the gradual recovery from the effects of "wintering" and the fall in production in September and November which was due to interference with tapping by the unusually frequent rain, in tapping hours, experienced during those months.

Chart D illustrates the yields in terms of equivalent rate of production in pounds per acre per annum. It will be most interesting to see how the yield graphs for 1930 compare with these illustrated for 1929. Already the published statistics make it possible for proper estimates of production to take the place of the rough approximations of the past. In the not distant future the data then available should enable estimates to be made by elementary arithmetical methods; with results which will approximate to certitude of accuracy.

The productions illustrated in Charts C and D confirm the rate of production of big estates which a study of the Federated Malay States Booklet of Statistics Relating to Rubber must have indicated as probable. They will, how-

ever, astonish all save those few who realised that the small holders' potential production (at all events for any immediate present) was greatly underestimated during restriction.

It is fitting, and may be helpful, in concluding this article to add a few notes regarding production in 1930.

The graphs of Chart D show clearly that, during 1929, notwithstanding the phenomenal yields which certain large estates have harvested from some rested areas and by the new small-tasks-and-early-tapping system the *average* yield per acre of the large estates was considerably below the *average* yield of the smaller holdings.

It must, however, be remembered that though many of the Asiatic owned big estates tapped daily on half-cuts during 1929, alternate day tapping on half-cuts, or its equivalent, is the most heavy system of tapping which has been used on almost all European owned estates. (There were only five, partial, exceptions.) It has also to be remembered that very many European owned estates used, during the whole of 1929, variations of the A.B.C. and other systems which definitely kept out of tapping, in rotation, parts of their areas: while others only tapped alternate daily on one-third-cuts. *The General Average* of tapping on big estates during 1929 was, therefore, under-tapping rather than over-tapping: and production of big estates in general inflated only, so far as it was inflated, by the rested area factor.

The writer is of opinion that at the end of 1929 big estates, considered as one group, stood possessed of bark reserves in excess of those proven essential: and thus possessed of what amounts to a "hidden" potential added productivity if policy and/or the market called for additional production in 1930.

Should the tapping policy of 1929 be retained during 1930 there is a sufficient area of young rubber available for addition to the tapped area fully to offset any falling off in the yield of older areas. The writer, for reasons indicated, holds the considered opinion that the total production of big estates in 1930 will somewhat exceed their production in 1929.

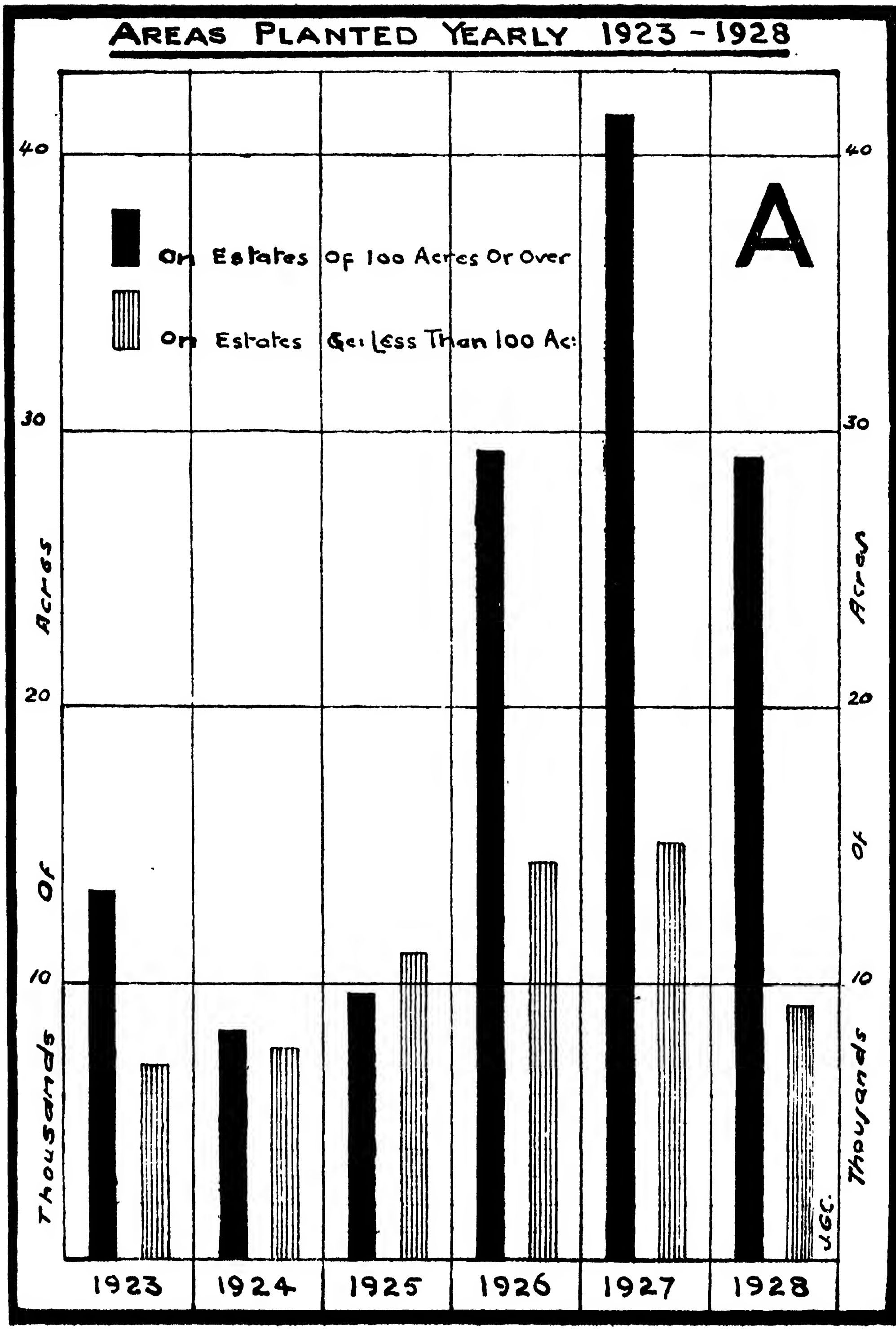
The position of the smaller holdings is quite different. They, too, during 1929 reaped the benefit of restriction-imposed resting and/or light tapping: but during 1929, beyond doubt, and—to a lesser extent—during the period July—December 1928 the smaller holdings were over-tapped.

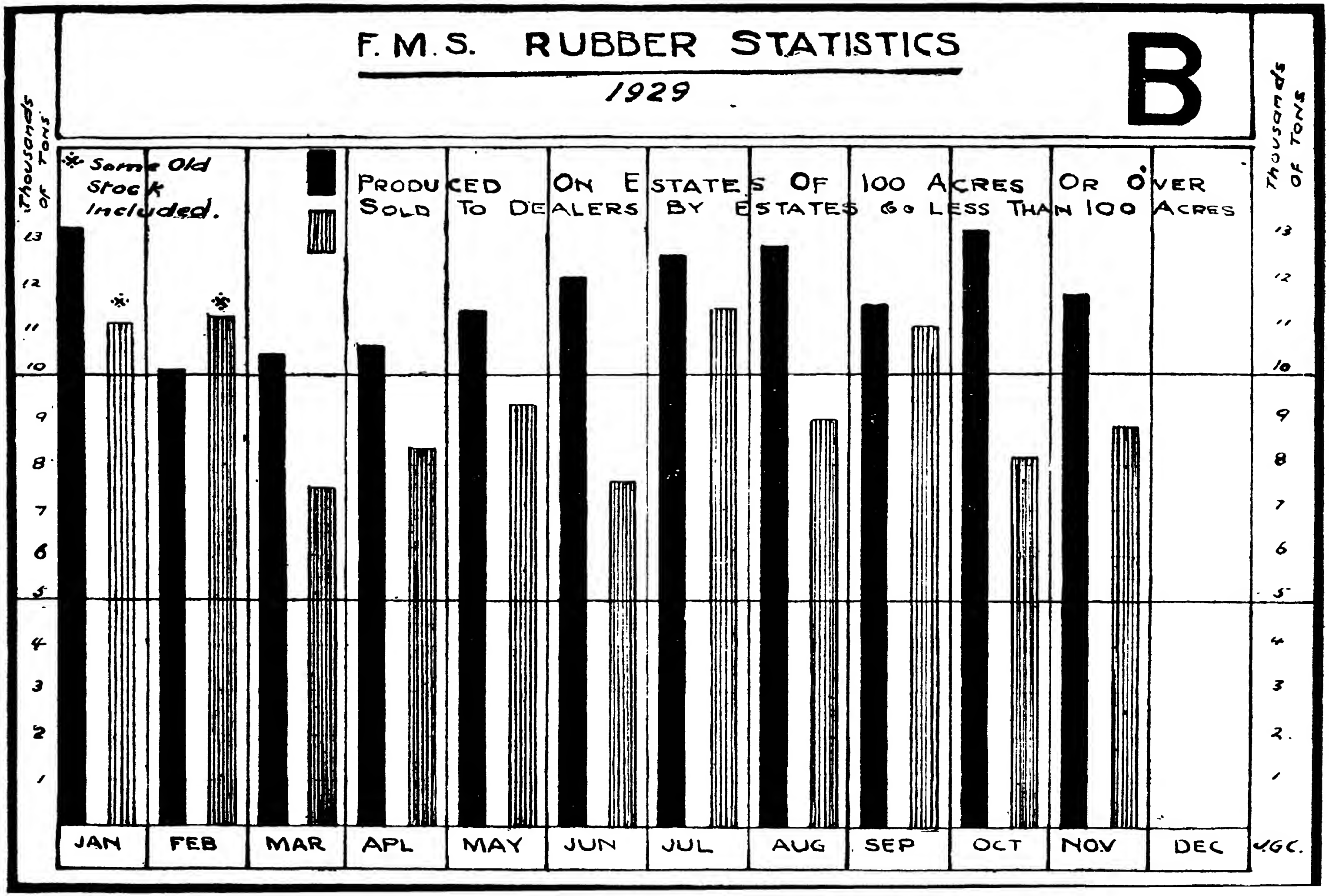
Though small holdings in general are not, as was stated at the beginning of this article, directly comparable with big estates (e.g. their stand of trees per acre is far higher, giving greater humidity, and they have not lost their top soil) it must be accepted as almost certain that after the "wintering" season in 1930—by which time, *inter alia,* the height of the average tapping out on small holdings will be considerably greater than it was during 1929—the average rate of yield per acre of small holdings will fall.

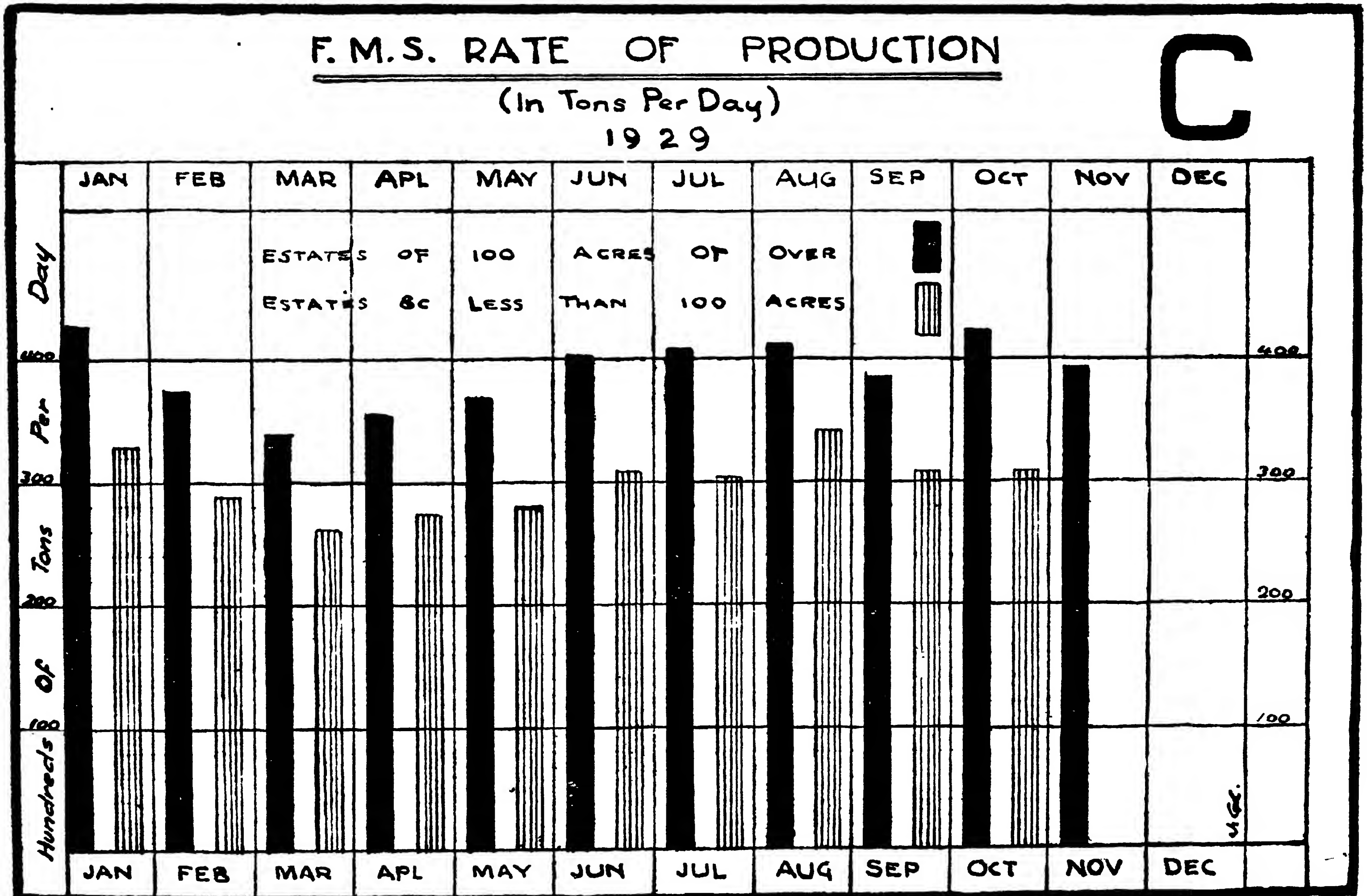
During 1930, the old rubber of the smaller holdings will continue to produce at a far higher rate than was generally thought possible, but, as stated in the preceeding paragraph, the rate of production is practically certain to fall appre-

ciably below that of 1929. Against that reduction is to be put the production of young areas first tapped in 1930: but the total decrease in the production of the old areas is almost sure to exceed any possible production of the newly tapped areas.

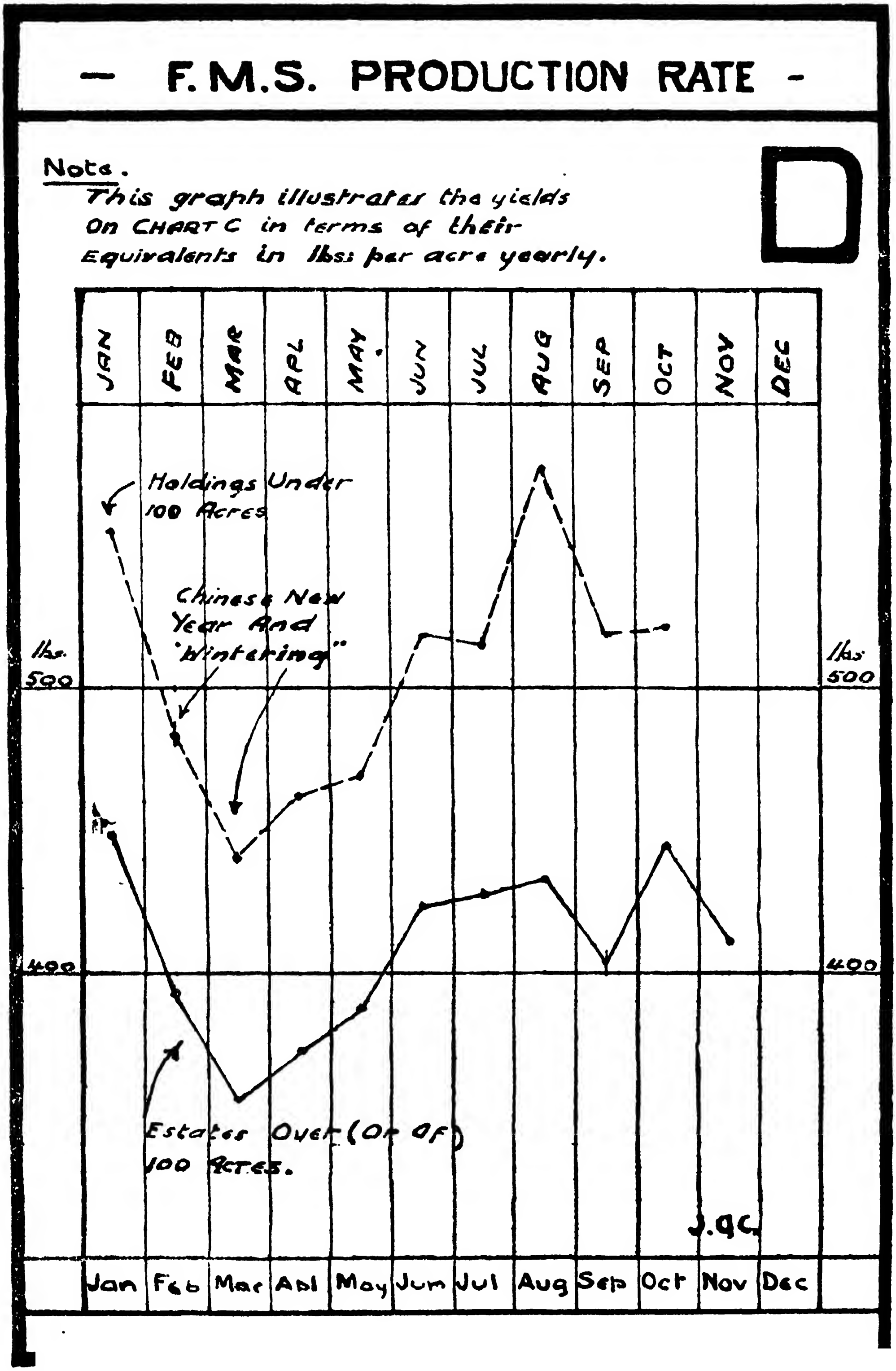
In short, the writer's conclusion regarding Federated Malay States production in 1930 is that, on balance, production in 1930 is likely to be almost the same as the production was in 1929: but that if market prices—or policy—called for it, the potential production of rubber in the Federated Malay States during 1930 could be increased, rather than diminished, as compared with the production during 1929.


AREAS PLANTED YEARLY 1923 - 1928
A
On Estates Of 100 Acres Or Over
On Estates Of Less Than 100 Ac:
40
30
20
10
Thousands Of Acres
1923
1924
1925
1926
1927
1928
J.G.C.


F. M. S. RUBBER STATISTICS
1929
B
* Some Old Stock Included.
Produced on Estates of 100 Acres or Over
Sold to Dealers by Estates of Less Than 100 Acres
Thousands of Tons
13
12
11
10
9
8
7
6
5
4
3
2
1
JAN
FEB
MAR
APL
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
J.G.C.



F. M. S. RATE OF PRODUCTION
(In Tons Per Day)
1929
C
JAN FEB MAR APL MAY JUN JUL AUG SEP OCT NOV DEC
ESTATES OF 100 ACRES OR OVER
ESTATES &c LESS THAN 100 ACRES
Hundreds Of Tons Per Day
100
200
300
400
U.G.



- F.M.S. PRODUCTION RATE -
D
Note.
This graph illustrates the yields On CHART C in terms of their Equivalents in lbs: per acre yearly.
JAN
FEB
MAR
APL
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Holdings Under 100 Acres
Chinese New Year And "Wintering"
lbs.
500
400
Estates Over (Or Of) 100 Acres.
J.G.
Jan
Feb
Mar
Apl
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

# AGRICULTURAL RESEARCH.*

Information has come to hand with regard to a number of actions recently taken on the recommendations of the Imperial Agricultural Research Conference, 1927.

## 1. Chain of Research Stations.

The question of the establishment of a station in North Queensland is under the consideration of the Commonwealth Council for Scientific and Industrial Research. The Committee on the organisation of a Colonial Agricultural Service have recommended that until the staff of the East African Agricultural Research Station at Amani had been brought up to full strength, no further central research stations should be created, although the establishment of further stations will be considered in due course by the Colonial Advisory Council of Agriculture and Animal Health. The Empire Marketing Board has approved in principle of a capital grant of £10,000 and an annual maintenance grant of £11,000 for five years, to the Onderstepoort Station, South Africa, to flunction as a central research station in animal diseases.

## 2. Interchange of Information.

The question of the establishment of Imperial Agricultural Bureaux in Great Britain for the interchange of information among agricultural research and other workers in the Empire, was discussed at a Conference of Empire representatives which met in London in November, 1928. A scheme for the organisation of eight bureaux to be financed from a common fund made up by contributions from the Empire Governments and providing £20,000 a year for the next five years was worked out, and an independent "Executive Council" under the Chairmanship of Sir Robert Greig set up. The "Executive Council" decided to start the Bureaux for Animal Nutrition (Aberdeen) Animal Genetics (Edinburgh) and Fruit Production (East Malling) as from 1st April, 1929; those for Soils (Rothamsted) and Plant Genetics (herbage plants) Aberystwyth, from 1st May, 1929; those for Animal Health (Weybridge), Plant Genetics (Cambridge) and Agricultural Parasitology (St. Albans) in the Summer as contributions are assured. The Empire Marketing Board has undertaken the responsibility for the publication for a limited period, of an Empire Journal of Dairy Research. The first list of new and useful publications dealing with the preservation and transport of foodstuffs, will be issued shortly by the Department of Scientific and Industrial Research. A list of agricultural research workers has been supplied to all workers whose names appear in the list. With regard to conferences, the Pan-African Agricultural and Veterinary Conferences will be held in Pretoria

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* Reprinted from "Tropical Agriculture." Vol. VI, No. 8.

in August, 1929, while the second West African Agricultural Conference is to be held in the Gold Coast in October, 1929.

### 3. Other Developments.

Amongst some of the other developments the following are mentioned: the establishment of a Colonial Advisory Council of Agriculture and Animal Health, a scheme for colonial veterinary scholarships, the consideration of practical steps that should be taken to secure the development of the teaching of biology by co-operation between Universities and Secondary Schools, and the question of developing the Edinburgh University Animal Research Department as a centre for animal genetics work. Soil and plant pathology problems have been brought to the notice of those concerned. A Virus Disease Committee has been formed. It is proposed to hold the Third Imperial Entomological Conference in London in June, 1930. A Committee of Chemists and Biologists has been formed by the Ministry of Agriculture to report as to the action required to carry into effect the recommendation of the Conference "that investigations should be made into the whole chemical field of insecticides and fungicides by chemists working in collaboration with entomologists and plant pathologists", while the question of the World Agricultural Census of 1930-1931 has been brought to the notice of the Governments of the Empire.

# MANURIAL EXPERIMENTS WITH RICE.

In the August number of the Tropical Agriculturist,* the Economic Botanist (L. Lord) of the Department of Agriculture, Ceylon, gives the results of certain manurial experiments with rice carried out in two central padi stations in that Island to test the possibility of improving rice cultivation by the use of artificial and green-manures. The results of the experiments with green-manures are of particular interest to padi growers in Malaya. In 1926, at Anuradhapura, the results of ploughing in a crop of Sunn Hemp (*Crotolaria juncea*) grown *in situ* was investigated, and it was found that a 33% increase in yield was obtained. Owing to this promising result further experiments were laid down at Peradeniya in the *yala* season of 1928 and the *maha* season of 1928-29 with the object of finding out, not only the effect on yield of ploughing in green-manure, but also to determine the effect of ploughing in the green-manure at different times before sowing the seed.

Following the lines adopted in the 1926 experiment, the green-manure for the 1928 one was grown on the land, but owing to the uneven growth of the Sunn Hemp on different plots, it was realized that another experiment with similar quantities of green manure applied to each plot was desirable; therefore, in the 1928-29 test, each plot received the same amount of green material brought in from outside. As in the permanent manurial series 1/80 acre bunded plots were used (the inner 1/100 ac. being harvested separately) and each treatment was replicated four times in randomized blocks. Five tons per acre of wild sunflower (*Tithonia diversifolia*) were applied; one lot five weeks, and one lot one week, before the padi was transplanted. The results are given in the following table—

| Treatment. | Calculated yield | | Control = 100 | Value of increase over control @ Rs. 2-50 per bushel. |
|---|---|---|---|---|
| | per lb. | acre. bus. | | |
| Control ... | 2482 | 59 | 100.0 | ——— |
| 5 tons green-manure (early) | 3318 | 69 | 116.7 | Rs. 25-00 |
| 5 tons green-manure (late) | 3847 | 80 | 135.3 | Rs. 52-50 |

The increased yields of both treatments over the control are statistically significant as is also the difference between the early and late application.

* Manurial experiments with Rice. Part 1, by L. Lord, Economic Botanist. Tropical Agriculturist Vol. LXXIII, No. 2. August 1929

There can be no doubt that under the conditions prevailing at Peradeniya, the application of green material is extremely efficacious in increasing the yield of grain and late application is better than early.

If it can be shown, as the results of further experiments, that one ton of green material is as good, or nearly as good as five tons, there will be much more hope of extending the practice of green manuring in Ceylon.

The Agricultural Chemists (A.W.R. Joachim & S. Kandiah) co-operated in the experiments in order that the changes in the nitrogen content of the soil during the course of the experiments could be determined. The results of their investigations were published in the May issue of the above named Journal,* briefly they found that—

(a) If green manures are incorporated in padi-soils at the time of puddling, i.e. late, large quantities of ammonia are made available at all stages of the decomposition process or of the crop growth; also the indirect effects of late green-manuring in increasing the surface film and hence the aeration of padi-soil and of the roots of the crop are appreciable.

(b) By early green manuring, i.e. the ploughing in of green manures when the soil is semi-dry and allowing it to lie fallow, large quantities of nitrates are formed which are lost as free nitrogen, or leached out when the fields are flooded and puddled. If early ploughing has to be done, water should be let in immediately after to keep the soil quite moist. Ammonia production, which is beneficial to wet land padi, is thereby encouraged and is not lost on subsequent flooding.

(c) From the above and other considerations it is obvious that from a chemical standpoint the burial of green-manures in padi-fields as late as possible before sowing or transplanting the crop is preferable to burying early.

It may be mentioned here that the practice of incorporating green material as late as possible before transplanting the young padi plants is one which is almost invariably followed by local Malays and shows once again how often old established agricultural operations are found to be scientifically sound.

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* Laboratory and Field Studies on Green-manuring under Paddy-land (Anaerobic) conditions. Tropical Agriculturist Vol. LXXII, No. 5. May 1929.

## WORLD TRADE IN SCRAP AND RECLAIMED RUBBER.

"The Rubber Age" for August 1929, contains several articles dealing with reclaimed and scrap rubber, perhaps the most interesting being on "World Trade in Scrap and Reclaimed Rubber" by Harry W. Newman of the Rubber Division, United States Department of Commerce.

The Author points out the great impetus to the industry resulting from the enforcement of the Stevenson Act 1925, which by sustaining prices at a high level, forced manufacturers to seek some element which would relieve the high cost of production, and turned them naturally to the use of reclaimed rubber. While for various reasons it is impossible to obtain reliable statistics of the consumption of reclaimed rubber, it is estimated that more than 40,000,000 lbs. (17,857 tons) of reclaimed rubber were exported in 1928. The trade in scrap, waste and old rubber used for reclaiming in the United States, Great Britain, Germany, Netherlands and Canada shews an increase of 183 per cent. between the years 1924 and 1928, which indicates the trend of the reclaimed rubber industry.

Despite the heavy decline in the price of crude rubber during 1928 upon the announcement and subsequent repeal of the Stevenson Restriction Plan, the demand for reclaimed rubber was fully maintained—in fact, it increased. During the period of high prices, manufacturers were induced to experiment with the reclaimed material and perfected it to such a degree that its use is not likely to be abandoned readily. Furthermore, manufacturers discovered that its use is not only economical in the fabrication of many rubber articles, but practical and best suited for their peculiar needs.

The reclaimers, however, have always in mind the possibility that a continuance of low-priced crude rubber may create a tendency to reduce the use of the reclaimed product and are considering the best means to develop its consumption. French reclaimers have already taken the initiative and recently held a meeting for their interests.

The United States, according to the official census of 1927, produced 330,435,663 pounds of reclaimed rubber for sale, and exported 19,130,429 pounds. The former figures, however, do not include the many thousands of pounds of rubber which were reclaimed at the factories of the large manufacturers for their own use, and for which no figures are available. Consequently, the total production of reclaimed rubber in the United States is far in excess of the amount which is sold on the open market.

The United States is maintaining its lead in the exports of the reclaimed product, the figures for the first half year of 1929 showing an amount in excess of 70 per cent of the total exported for the previous year. Canada in 1928 took 82 per cent. of the United States total exports of reclaimed rubber, and Great Britain—the only other important outlet—took 12 per cent. of the total.

The United States draws the bulk of its export trade in scrap and old rubber from the 73,890,000 automobile tires which are annually discarded.

## Exports of Reclaimed Rubber.

The following table shows the trend of exports of reclaimed rubber during the past five years from the countries which separately enumerate reclaimed rubber in their trade statistics.

Exports of Reclaimed Rubber
(Pounds).

| Country. | 1924 | 1925 | 1926 | 1927 | 1928 |
|---|---|---|---|---|---|
| United States | 5,458,157 | 10,239,876 | 12,075,640 | 19,130,429 | 21,452,956 |
| United Kingdom | 816,400 | 3,574,900 | 4,582,500 | 5,690,900 | 8,064,625 |
| Italy | 180,948 | 323,768 | 236,710 | 1,098,694 | 297,540 |
| Netherlands | 3,218 | 15,686 | 6,065 | 130 | 2,204 |
| Sweden | 11,392 | 604 | 4,259 | 17,632 | 31,411 |
| Poland | ........... | . ......... | ............ | 3,306 | . .. ..... . |

The reclaiming industry in France is of importance. Inasmuch as the domestic supply of scrap rubber is inadequate for the national requirements, large quantities are imported—principally from the United States. Great Britain is the second foreign source of supply, and Germany probably occupies third place. The recent failure of a large German reclamation plant has directed extra quantities of old rubber from Germany into France.

Owing to the increased production in the past three years, the supply of reclaimed rubber from domestic sources is more than adequate for the French demand and augmented quantites are exported. From estimates made by leading producers, the annual production approximates 9,000 metric tons, or about 30 tons per working day. In addition, large manufacturers such as Michelin, Hutchinson, Dunlop and others have their own plants for reclamation operations, the production totals of which are not available.

The Caustic Soda process is used practically by all rubber reclamation units in France. Economy in production is favoured by low wages.

The writer gives details of the reclaimed rubber trade on the Continent, shewing that these countries have found it necessary to import considerable quantities of scrap and reclaimed rubber for manufacturing purposes.

The larger British reclaimers of rubber scrap are located in the north of England, particularly around Manchester, where they consume not only the large surplus of old rubber articles discarded in the Kingdom, but import large quantities from the United States and the Continent. The latest available figures indicate that the United States supplies about 60 per cent. of the British imports of waste and reclaimed rubber, and of the total British imports about 40 per cent. is shipped to Manchester.

Reclaimed rubber has also found considerable markets in other countries, notably in Japan, Australia and Italy.

## BOOK REVIEWS.

### "Technical Reports and Reports of Divisional Agricultural Officers' of the Ceylon Department of Agriculture for 1928"

The Reports of the Technical Divisions and of the Divisional Agricultural Officers of the Ceylon Department of Agriculture for the year 1928 have recently come to hand. A departure has been made from the usual procedure inasmuch as the whole of the Technical Reports are bound in one volume and the Reports of the Divisional Officers in another, instead of as previously, being issued as a series of separate bulletins; this has the advantage of greater convenience and moreover serves to emphasise the distinction between the two branches viz. Research and Extensional into which the work of Agricultural Departments naturally tends to divide itself Technical Reports comprise those of the Mycologist, Entomologist, Chemist, Economic Botanist and Agriculturist in Charge of the Central Experimental Station. In the Entomological Section considerable space is devoted to a review of the work on Termites to which the Division has given much attention during the year, the work subdividing itself into two sections, viz. work on the various species of caloterms which attack living plants, and those Termites which attack buildings. A useful adjunct to the Mycological and Entomological Sections of the Report is the appending thereto of the Reports of the divisional plant inspectors which facilitates the whole of the pest and disease work being viewed in complete perspective.

A considerable part of the work of the chemical division was concerned with soils, and in particular with attempts to estimate by the examination of soil suspensions, the amount of colloidal matter carried away from the soil erosion plots at the experiment station.

The report of the Economic Botanist is mainly concerned with padi work which has now been established on a considerable scale; the work in Ceylon is still confined to pure line selection in which direction it is held that the possibilities are still so large that no serious attempt at producing superior strains by hybridization have yet been made. Four rice breeding stations have now been established while the strains evolved are tried out at twenty-three test stations supervised by the Divisional Agricultural Officers. During the year 330 new selections were made and nearly 500 were in addition discorded.

The reports of the Divisional Agricultural Officers comprise an account of the various extensional activities undertaken. The Island is at present divided into four agricultural districts viz. Central, Southern, Northern and North-Western each of which is in charge of a trained divisional officer with subordinate staff.

In each division there exists a series of experiment demonstration and test stations which serve as centres for trials of new and improved crops and varieties

of crops and agricultural methods as well as for the distribution of planting material.

In two divisions viz. The Central and the Northern, Agricultural Schools are maintained, to give training to the sons of native agriculturists, while there are also special classes for headmen and village school teachers. Each divisional officer has charge of the school garden work in his division, in all there are in Ceylon 663 school gardens as against 437 in the F.M.S. and S.S., the standard of work in this direction is high in Ceylon, progress being stimulated by competitions for which prizes are provided. Agricultural competitions were held in all districts with the object of stimulating the improvement of the standard of cultivation by small holders, competitions being either on the basis of a particular crop or else on a general basis. Government financed produce purchase schemes were operated in respect of tobacco in the Northern Division and cotton in the Hambantota district of the Southern Division; these schemes have for their object the stimulation for native industries by the provision of marketing facilities on a fair basis. The schemes appear to be having favourable effect inasmuch as areas cultivated are steadily increasing. Other activities have comprised meetings and demonstrations, while the supervision of co-operative Credit Societies is also vested in the divisional officers. The report as a whole comprises a record of a large amount of useful work on soundly conceived lines.

H.A.T.

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## "The Tropical Crops."

A POPULAR TREATMENT OF THE PRACTICE OF AGRICULTURE IN TROPICAL REGIONS WITH DISCUSSION OF CROPPING SYSTEMS AND METHODS OF GROWING THE LEADING PRODUCTS.

BY OTIS WARREN BARRETT.
(*New York: The Macmillan Co. 1928.*)

The subject of tropical agriculture is one of such magnitude that any attempt to deal with it in the space of 445 pages must of necessity become little more than a summary of crops and crop systems. In the particular case the author, who is Director of Agriculture and Labour, Porto Rico, has endeavoured to present the data regarding the world's principal tropical crops in the light of first hand observations based on thirty years of practical experience.

The greater part of the book is confined to the major permanent and semi-permanent tropical crops, more particularly to those of the Caribbean—American zone with which the writer is evidently most familiar. Such crops as Coffee, Cocoa, Coconuts, Citrus, Bananas and Sugar Cane are each dealt with at some length as are also Rubber and Pineapples, two crops of interest to readers in this country.

On the other hand, in so far as the main arable and dry zone crops of the Tropics are concerned, the subject matter is decidedly curtailed. Rice, which the author acknowledges to be the world's most important crop is dismissed in the space of three pages. Other grain and forage crops, oil seeds, fibres of the importance of Sisal and Jute, together with Tea are similarly but briefly dealt with. Furthermore, such crops as Cotton and Tobacco, though extensively grown in the sub-tropics, are nevertheless of considerable importance and interest in tropical agriculture and deserving of more attention than has been given them in the text.

The Chapter devoted to tropical field practices and conditions is of interest having regard to the profound importance of many of the principles laid down. Here again, however, information is so curtailed as to render it of little practical value.

Presenting as it does a summarised review of the world tropical crops and crop systems together with an impression of the ever-increasing importance of the products of tropical agriculture in the economic life of the temperate regions, the book is of interest. Its main value, however, lies in the subject matter dealing with those crops with which the author is definitely familiar and which he has been enabled to treat in the light of long practical experience of their culture and economic aspect.

R.G.H.

## MALAYAN EXHIBITION, 1930.

The Seventh Annual Malayan Exhibition, organised by the Malayan Agri-Horticultural Association, will be held during the Easter Holidays, 19th to 21st April, 1930, on the Association's ground at the junction of Ampang Road and Circular Road, Kuala Lumpur. The usual sections for Agriculture, Horticulture, Rubber, Poultry and Village Industries will be included, preliminary schedules for which have been prepared and may be obtained on application to The Secretary, M.A.H.A., P.O. Box 323, Kuala Lumpur, to whom all communications in connection with the Exhibition should be sent. It is anticipated that the Department of Agriculture, the Rubber Research Institute and the Committee for Public Health Education will co-operate by staging departmental exhibits.

## FROM THE DISTRICTS.

### The Weather.

Unusually dry weather for December prevailed generally although fairly frequent and sometimes heavy afternoon showers fell in parts of South Perak, Selangor and Negri Sembilan. The contrast to the usual December conditions was particularly striking in Pahang where the rivers showed no signs of flooding whilst in the Pekan district the rainfall was only about 5 inches as compared with an average precipitation for December of over 28 inches.

### Remarks on Crops.

*Rubber.*—Brief notes are to hand from South Perak regarding a replanting programme to replace 27 year old trees. Replanting with budded stumps is being done immediately after clearing off the old trees and the programme provides for planting a definite area each year. Prices paid for small holders rubber ranges from \$26/- a pikul for unsmoked to \$28/- to \$30/- a pikul for smoked sheet. It is reported from West Pahang that this low price is reflected in the lower standard of general maintenance in the holdings and increased difficulty experienced in obtaining efficient control of disease, especially that of Mouldy Rot which entails cessation of tapping for a period. This experience is likely to become general if the price remains for a prolonged period at its present level. The incidence of Mouldy Rot (which in small holdings, is the disease of main importance at the moment) is directly connected with weather conditions. Thus, from Selangor and the Perak South areas bordering thereon and from Negri Sembilan, the disease is reported to be much in evidence, whereas elsewhere it has shown less virulence, although in parts of West Pahang the difficulties mentioned in obtaining efficient control have resulted in a slight increase in the number of cases reported.

*Padi.*—In the north of the Peninsula, crop prospects as regards late planted areas are very uncertain, as the dry weather of December has had a bad effect on padi that is in the stage when it should be making rapid growth. In these areas the unseasonable weather has favoured the increase of certain pests, notably a leaf-hopper (*Sogata pallescens*) which of late years has been responsible at this time of year for considerable damage to the padi crop at such times as general conditions have been conducive to the insects' rapid reproduction. Unfortunately these unfavourable conditions for the crop prevail over a large portion of the important padi areas of Krian and Province Wellesley. Suitable weather may yet result in a fair harvest, but is unlikely, as weather that would be suitable for the crop will not be such as is normally experienced during the next three or four months. In areas where early planting was rendered possi-

ble by earlier rains or a sufficiency of irrigation water, crop prospects are good. This applies to Upper Perak and a large part of the district of Kuala Kangsar.

Crop prospects are reported to be promising in South Perak and in the inland districts of Selangor. In Negri Sembilan a good crop is expected except in the mukims of Pantai and Lenggeng, whilst in Malacca prospects as to yield are bright, especially in Alor Gajah district.

In West Pahang a fair crop was reaped in mid-December in Lipis and Temerloh districts and is now being reaped in Bentong district. In Raub district the age of the padi was extremely variable. A fair crop was being reaped in Dong mukim whereas in other mukims plants were in the growing stage and in one mukim transplanting in progress. In East Pahang the harvest which is completed, was variable but on the whole somewhat poor, plants having suffered from drought during the growing period.

Organised rat control with the help of a special staff is established in the padi areas of Krian, Province Wellesley and Malacca. Rewards were paid during the month for 29,250 rats killed in Krian, 34,350 in Province Wellesley and 1,919 in Malacca. The organisation has been inaugurated only recently in Malacca and cultivators are as get reluctant to bring in tails to claim the reward. The same difficulty was experienced in Krian and Province Wellesley when a Rat Campaign was first organised in those areas. In parts where no special organisation exists, distributions of traps and poison have been made, the success varying in proportion as to whether the majority or only a few cultivators make practical use of the advice given them. Experience in Krian over a number of years indicate that rats can be effectively controlled in padi areas if trapping and poisoning is continuously carried out with vigour over the whole area concerned.

*Tea.*—A fresh application for a grant of a little over 100 acres for this crop was made in South Perak.

*Bananas.*—Decreased productivity of this crop on an area of approximately 3,500 acres in Negri Sembilan was brought to the notice of this Department. Undoubtedly, the reasons for declining yields are decreased soil fertility and Panama Disease, the effects of the latter possibly being inversely proportional to the degree of soil fertility. The maintenance of the soil in a reasonable state of fertility for this gross feeding crop in a country where farm-yard manure is a scarce commodity is a problem not easily solved. Recent investigations indicate that Banana production in Malaya is insufficient to meet the demand and it would appear to be desirable to increase the area of this crop, more especially in localities situated within convenient reach of the large towns.

## Notes on Demonstration Stations and Padi Test Plots.

*Kuala Kangsar.*—Approved varieties of Bananas were planted and a model school garden laid down during the month. Experiments with Poultry were

commenced with imported birds consisting of White Wyandottes, Rhode Island Reds and Light Sussex fowls and Aylesbury and Khaki Campbell ducks.

*Seremban.*—Plantings of further fruit trees, Coffee, Maize and various varieties of Sweet Potato were made and Soya Beans and fruit seedlings were distributed.

In West Pahang, measurements of standard trial plots were made at the Dong and Temerloh Padi Test Stations whilst the Bananas and Food Crops made good growth at Kuala Lipis Demonstration Station. At Pekan, the wet padi on the Test Plot was harvested and a plant house was in course of erection at the Demonstration Station. The dry padi areas proved a complete failure owing to drought.

*Malacca.*—The Padi Station at Pulau Gadong looked very promising at the end of the month when it was visited by the Director. From the Fruit Station on Pringgit Hill distributions were made for the establishment of a School Fruit Garden.

## School Gardens.

In Province Wellesley and Penang, all school gardens were reported upon in connection with the annual prize competition. Reports from elsewhere indicate general progress towards assumption by the Field Officers of fuller responsibility for the condition of School Gardens.

## Other Items of Interest.

The dredged and slimed plot at Kamunting in North Perak on which green dressings have been established with the object of rendering the land capable of producing good padi crops has been bunded and a waterway made with a view to planting the first padi crop thereon next season.

The Perak Water Hyacinth gang was engaged on clearing the Samagaga river and other waterways in the vicinity of Krian irrigation area, whilst the Province Wellesley gang was employed in clearing the weed from minor streams and drains. Isolated patches were dealt with elsewhere.

It is reported from Negri Sembilan that the price of locally grown Chillies has become considerably enhanced of late. At present prices the cultivation of this crop offers good profits to enterprising small cultivators.

In Malacca, the Field Officer attended a demonstration given at Mr. Van Cant's plant for the extraction of Rubber Seed Oil by chemical process.

## DEPARTMENTAL NOTES.

### Field Officers' Conference 1929.

An interesting new departure in departmental policy which has recently taken place consists in arrangements for the holding of Annual Conferences of Field Officers. The object of such conferences is to make provision for the regular interchange of views on matters in the Field branch of the Department, to provide facilities for comparing results and methods of work in different districts, to permit of personal contact being established with the Research Officers of the Department and to allow exchange of views between the Field Officers and the Head Quarters Staff.

The work of the Field branch of the Department consists essentially of what is termed extensional work combined with the control of pests and diseases. Hitherto extensional work performed by the Department has been restricted in character, and its scope is far less extensive than similar work in the neighbouring colony of Ceylon and in the Dutch East Indies. For some time past plans have been under discussion for extending and amplifying the work in progress with a view to bringing it more in line with modern ideas, and in this connection a scheme for extension of activities has recently been drawn up; one of the main objects of the conference was to enable these proposals to be discussed with the Field Officers of the Department as a whole so as to ensure so far as possible that the programme was co-ordinated with the needs of the country.

The main points of the proposals consist in the establishment of a considerable number of Demonstration Plots and Test Stations throughout the Peninsula together with facilities for distributing planting materials. At present such facilities are largely non-existent. At the same time re-organisation of the Asiatic staff in the Field side was discussed and details in relation thereto worked out with a view to submission of a definite scheme to the Government. Other matters considered comprise questions in relation to the establishment of School Gardens, co-operation with the Rubber Research Institute and with the Co-operative Department, in propaganda and extensional work, the organisation of agricultural shows, and the possibilities of film propaganda. On the second day of the conference Officers of the Co-operative Department and the Rubber Research Institute attended the meeting, by invitation, and took part in the discussion of proposals for co-operation with their respective organisations.

During the conference members visited Serdang Experimental Plantation, the Rubber Research Institute and the Experimental Station of the Rubber Research Institute at Sungei Buloh, while the Director of the Co-operative Department made arrangements for delegates of the Conference to see the departmental film on co-operation.

It is proposed to hold these conferences annually in future; the results of the 1929 conference are distinctly encouraging and there would appear every reason to hope that this step will prove of value in bringing about an increase in the efficiency and the utility of the Field side of the department.

## Appointments.

Mr. F. C. Cooke, A.R.C.S., B.Sc., A.M.I. Chem. E., appointed Assistant Chemist for Copra Investigation on 22nd August, 1929, and arrived on 19th September, 1929.

Mr. R. G. H. Wilshaw, B.A., B.Sc., A.I.C.T.A. appointed Assistant Agricultural Chemist on 19th September, 1929, and arrived on 17th October, 1929.

## Leave.

Major C. D. V. Georgi, O.B.E., Acting Agricultural Chemist, has been granted eight months and thirteen days leave on full pay, with effect from 15th November, 1929, inclusive.

Mr. W.N.C. Belgrave, Plant Physiologist, returned from leave of absence on 29th November, 1929.

Mr. D. H. Grist, Agricultural Economist, returned from leave of absence on 29th November, 1929.

Mr. A. E. Coleman-Doscas, Agricultural Field Officer returned from leave of absence on 18th December, 1929.

# MARKET PRICES.

## December 1929.

*Rubber.*—The average London price for December 1929 was 7.9 pence per lb., the highest price quoted being 8 1/16d., the lowest 7 13/16d. The average price in Singapore was 26½ cents; the lowest being 25½ cents, and the highest 27¼ cents.

*Copra.*—On November 27, Straits F.M.S. Copra was quoted in London at £23.7.6 per ton C.I.F., compared with Ceylon F.M.S. at £24.7.6.

Singapore prices varied from $9.55/9.35 S.D. and $9.05/8.85 F.M. per picul.

*Palm Products.*—Kernel was dull and unchanged at the beginning of the month: deodorised 41s., crude 35.6d. spot. Palm oil shewed some recovery, the market being fairly steady, but business only moderate: Lagos 34s; softs 31.6d; mediums 31.9d; hards 34s; bleached 34s.

*Coffee.*—"The British Trade Journal" for December states:-

"The glut in coffee, and the difficulties of the Brazilian Coffee Defence Committee continue to hamper the market. The fall in prices continued during November, Jamaica dropping from 220s. to 210s. per cwt., Costa Rica med. from 155s. to 150s., Kenya, good med. to 105s., and Brazils (Santos) to 90s. East African supplies increased considerably in 1929 and met with excellent demand. The only remedy for the Brazilian position is to reduce production or discover new markets and stimulate the demand by well considered propaganda."

*Tapioca.*—Med. Pearl 23s. to 24.6d. per cwt. E.I. Flake, fair, spot 21.6d. per cwt.

Singapore reports on 21st December; Flake, small fair. $5½ per picul; Pearl $8 per picul.

*Sago.*—Pearl, Fair $8¼, Flour No. 1 Borneo, Sarawak, Singapore $4.45/4.57½ per picul.

*Pineapples.*—The price for 100 fruits ruling in Singapore ranged from $1.50 to $1.80 for average, $2.50 for best quality and eighty cents for unripe fruits. The price for No. 1 quality tinned Singapore Pines was $3.75 a case of 48 tins of 1½ lb. cubes.

*Spices.*—Cloves, Penang 1s. 8d. to 1.10d.

Zanzibar 1s. 1¼d.

Mace ord. to gd., per lb. 3.3d. to 3.10d. Pepper, black. Singapore prices $46/45 per picul on December 14, falling to $44¾/43½ on December 21st.

Nutmegs. 110 per lb. $34 Singapore on December 21st.

80 per lb. $37 Singapore on December 21st.

It is proposed to hold these conferences annually in future; the results of the 1929 conference are distinctly encouraging and there would appear every reason to hope that this step will prove of value in bringing about an increase in the efficiency and the utility of the Field side of the department.

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Nutmegs. 110 per lb. $34 Singapore on December 21st.
80 per lb. $37 Singapore on December 21st.

*Essential Oils.*—Citronella oil—Java 3.4d. per lb. c.i.f. U.K. port. The market has continued to rule strong.

Lemongrass oil—4s. per lb.

Olive Oil (90/92%)—8s. per lb.

Patchouli oil—Singapore spot cheaper from 20s. to 21s. per lb.

*Gambier.*—No. 1 and No. 2 cube, \$14⅜ per picul at Singapore.

The above price list is intended to indicate the trend of prices during the latter half of November and the first half of December. With the exception of rubber for which the daily quotations for December have been examined, the information given has been drawn from The Singapore Chamber of Commerce Market Reports; "The British Trade Journal and Export World" for December; "Tropical Life", December; "The Chemist and Druggist", December 7th; "The Chemical Age", November 30th; and "The Perfumery and Essential Oil Record" November 19th.

Prices stated in sterling are London quotations, while those in Straits dollars (\$1 = 2s.4d.) are Singapore quotations.

It is hoped that present efforts will be successful in arranging for a special monthly market report from London so that readers may be in possession of the latest market movements.

THE

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# Committees of the Department.

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### The Advisory Committee.

The Director of Agriculture (Chairman).
The Director, Rubber Research Institute.
The Director of Co-operation.
Mr. O. T. Dussek, representing the Education Department.
Yang Teramat Mulia Raja Abdul Aziz, C.M.G., Raja Muda of Perak.
The Hon'ble Mr. Egmont Hake, M.F.C.
Mr. Choo Kia Peng, C.B.E.
Mr. J. Melville.
Mr. M. J. Kennaway.
Mr. L. P. Jorgensen.
Mr. W. A. Stanton.
Mr. G. S. Reis, B.Sc. (Agric.)
Mr. A. Sharples (Secretary).

### Agricultural Pests Supervising Committee.

(Under Sec. 4 of Agricultural Pests Enactment 1913).
The Director of Agriculture (Chairman).
The Hon'ble the Legal Adviser.
Mr. F. H. Mustard.
B. J. Eaton, O.B.E.

### The Departmental Technical Committee.

The Director of Agriculture (Chairman).
The Heads of Divisions.
Mr. F. S. Ward (Secretary).

### Coconut & Oil Palm Research Committee.

The Director of Agriculture (Chairman).
The Mycologist
The Agriculturist.
The Economic Botanist.
The Plant Physiologist.
The Agricultural Economist.
The Agricultural Chemist.
The Entomologist.

THE

# Malayan Agricultural Journal

FEBRUARY 1930.

## EDITORIAL.

**Malayan Pineapples.**

Most residents in Malaya are aware of the regular export in canned pineapples from Singapore; but it is probable that many may not realise the extent and growing importance of this industry. We shall have occasion in a future article to enter more fully into this subject, but for the present, attention is drawn to recent efforts that have been made to increase the demand for this delicacy in the United Kingdom.

For the past two years Malayan (or Singapore) canned pineapples have been systematically advertised through the medium of Exhibitions. In all instances the exhibits have been arranged and staged by the Malayan Information Agency in collaboration with the Empire Marketing Board. The Department of Agriculture, S.S. & F.M.S., has assisted by supplying exhibits, photographs, information and leaflets. We would take this opportunity of thanking the various commercial firms interested in this commodity for their ready assistance.

The first of the exhibitions at which a display was made was at the Imperial Fruit Show in October, 1928, at Manchester, where Malayan exhibits of pineapples attracted considerable attention. The matter was followed up and similar displays were made during 1929 at the British Industries Fair, the Ideal Homes Exhibition, the North East Coast Exhibition, the International Grocers' Exhibition, and the Imperial Fruit Show, Birmingham. Included in such exhibitions were demonstrations of cooking with the use of Malayan pineapples and the sale of a book of recipes of fifty different dishes that can be made from this canned fruit. The success of such methods of publicity are undoubted. For instance, a visitor stated from his observation at the Imperial Fruit Show 1928 that the crowd before the Malayan Stand at any given moment was six times as large as that to be found before any other exhibit in the Show.

It is becoming clear that the efforts made are proving successful. It is reported that representatives of firms are now coming forward voluntarily to offer supplies of their brands to be shewn at stands at Exhibitions. Furthermore, there is every reason to think that the demand for Malayan pineapples is being considerably stimulated by the action which has been taken and that this will in due course react favourably on market conditions.

The exports of Malayan pineapples are taking a more important place in our trade each year. While in 1920 the exports amounted to about 10,000 tons,

the Trade Returns for 1929 state that the exports for that year amounted to 58,692 tons, an increase over the previous year of 12,292 tons or 21%. The exports of pineapples from Singapore are valued at over $9,000,000 and represent the fifth largest export industry in the Peninsula. This production causes Malaya to rank as the second largest producer of canned pineapples in the world, the first being Hawaii.

Over 80% of these exports go to the United Kingdom. It is proposed to continue the publicity campaign and if possible to extend it to the Continent of Europe where a considerable potential market for canned pineapples is believed to exist.

In view of the important trade which is now extending, it behoves the producing industry to continue their efforts in maintaining quality while not enhancing the cost of this "poor man's luxury," and for us to establish the planting industry on a surer foundation than exists today, when pineapple cultivation is considered merely as a catch crop with rubber or other permanent crops.

**Coconuts.**

In the present issue of this journal will be found two articles dealing with coconuts and copra. The Coconut and Oil Palm Research Committee of this Department has, at their deliberations, exhaustively surveyed the work already accomplished on coconut research both in Malaya and elsewhere, and has drawn up schemes for future research which are designed to have the greatest effect without undue overlapping between the different workers. The present position regarding this subject is outlined in Mr. Sharples' paper on Coconut Research.

It is clear that abundant scope exists for research both in relation to the selection, breeding and cultivation of coconuts and also in the preparation of copra and coconut oil for the market.

One of the earliest steps taken by the Committee was to recommend the delegation of an officer of the Department to enquire into the conditions governing the market for copra and coconut products in the United Kingdom; and acting thereon, Mr. D. H. Grist was appointed by the Government to undertake such an enquiry during a recent period of leave in England. The results of Mr. Grist's enquiries are contained in the report by him published in this number. The report emphasises the fact that the purchase and sale of copra is conducted on very stereotyped lines which militate against endeavours to improve the quality of the produce in the tropics. In such circumstances, producers are bound to find themselves handicapped in the early stages by the fact that attempts to improve the quality of the produce are not certain to be recognised by an immediate improvement in price. Such a state of affairs is, of course, unfortunate; but it may be pointed out that there is hardly a single tropical product for which the market is based on variation in quality which at the outset did not find itself confronted with similar difficulties. The immediate task with which copra producers are faced therefore appears to be twofold: firstly by systematic investigation of ascertaining the optimum conditions

for the preparation of a standardised product and secondly, of convincing buyers that such a procedure represents a distinct advance over the method at present in vogue.

It is interesting to recall that similar proposals were put forward in the Philippine Islands in 1917 but that, so far as can be ascertained, no steps have been taken to give practical effect thereto.

It is to be hoped that the work recently initiated in Malaya, combined with the projected Coconut Research Scheme in Ceylon, as well as the copra research work now being undertaken at the Biological Research Station, Slough, attached to the Imperial College of Science and Technology, will cause attention to be focussed on this point where apparently abundant scope for improvement exists.

**Bananas.**

Mr. F. S. Ward, Assistant Mycologist, has been engaged for some time on the diseases of bananas, especially that most destructive disease known as Panama Disease. In the course of his researches he has accumulated much information on the local varieties of bananas and the methods of cultivation, which is here placed on record. It is perhaps not generally known that in certain districts there are considerable areas of land under banana cultivation, the produce of which finds its way to the larger towns of the Peninsula. We hear of an enterprising Chinese who has commenced the manufacture of banana flour, a subject which Mr. Ward deals with in an article to appear in the next number of this journal.

**Film Propaganda.**

Mr. J. Corrie deals in his article contained in the present number with the subject of film propaganda in relation to this Department. In a country such as Malaya, there is a great educational value in films, demonstrations and shows, as a means of appealing to the *rayat*, and the commencement made in film propaganda coupled with the organisation which already exists for demonstrations, agricultural shows and publications in the vernacular should go far towards bringing home to the cultivators the lessons to be learnt from the progress of agricultural science.

The subject of Film Propaganda was discussed at considerable length at the Agricultural Field Officers Conference held in October last and as a result, a joint committee consisting of the Departments of Agriculture, Co-operation and Rubber Research Institute was nominated for the purpose of making concrete proposals. The committee has devised a scheme for co-ordinated work between the three Departments on these lines which involves the organisation of a propaganda van which will tour the country and give displays of agricultural and co-operative films at suitable centres. Financial support for the scheme has already been promised by the Rubber Research Institute and it is hoped that the Federated Malay States Government may be able to see their way to accord its approval of this proposal. Striking successes have already been achieved under not dissimilar conditions in India, while more or less similar proposals are, it is understood, contemplated in Ceylon.

# ORIGINAL ARTICLES.

## BANANA GROWING IN MALAYA AND THE PRESENCE OF DISEASES.

BY

F. S. WARD,

*Assistant Mycologist.*

### Early Historical References to the Banana.

The original habitat of the edible banana was, in all probability, in the humid tropical Indo-Malayan regions. It appears that the banana was first a root crop, the roots even yet being used by the natives of some countries, while the tender heart was doubtless also an article of food, as it is to-day in Abyssinia. Cultivated for its roots, the banana began to produce better fruits, perhaps by chance, or perhaps as a result of asexual propagation, and at a very early date must have become more prized for the latter than for the former.

From the Indo-Malayan region, according to the generally accepted account, man must have carried the banana on his migrations both eastward to the islands of the Pacific Ocean, and perhaps to America; and westward to India, the Mediterranean region, and finally on to America.

The first clear references to the banana are found in Greek, Roman, and Arabian authors. Pliny is commonly held to be the first writer to describe the banana with regard to which he gives the following interesting account.* "There in another tree in India of still larger size and still more remarkable for the size and sweetness of its fruits upon which the sages (Brahmins) of India live. The leaf of this tree resembles, in shape, the wing of a bird, being three cubits in length and two in width. It puts forth its fruit from the bark, a fruit remarkable for the sweetness of its juice, a single one containing sufficient to satisfy four persons. The name of this tree is pala, and of its fruit ariena. They are found in the greatest abundance in the country of the Sydraci, a territory which forms the extreme limit of the expedition of Alexander." The name pala is said still to be found as a vernacular name of the fruit in India, while his remark as to its being the food of the sages has given the specific name to the ordinary cultivated banana—*Musa sapientum*, "the Musa of the wise men".

Alphonse de Candolle, in his "Origin of Cultivated Plants", says: "The antiquity and wild character of the banana in Asia are incontestable facts. There are several Sanskrit names. The Greeks, Latins, and Arabs have mentioned it as a remarkable Indian fruit. There is an immense number of varieties of the banana in the south of Asia, both on the islands and on the continent;

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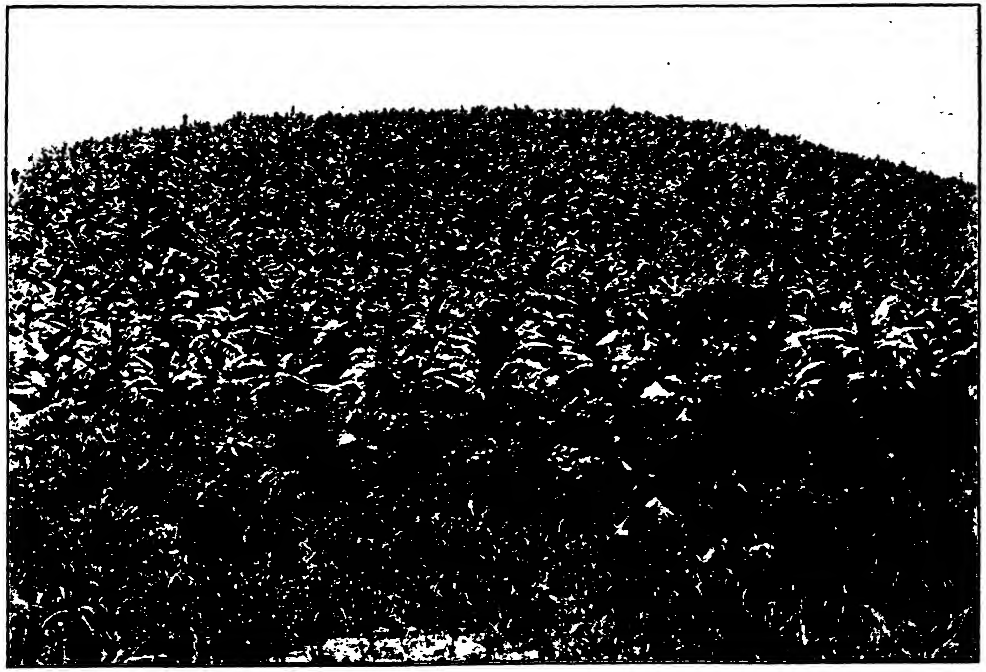
* Journal of Heredity, Vol. V, 1914.

PLATE I.



A typical flourishing hill of Bananas approaching maturity in the Jelebu District.

PLATE II.

An old hill of Bananas in the Jelebu District, showing where "Lalang" grass has been allowed to creep in, due primarily to poor cultivation methods.

the cultivation of these varieties dates in India, in China, and in the Archipelago from an epoch impossible to realise; it even spread formerly into the islands of the Pacific and to the west coast of Africa; lastly, the varieties bore distinct names in the most separate Asiatic languages, such as Chinese, Sanskrit and Malay. All this indicated great antiquity of culture, consequently a primitive existence in Asia, and a diffusion contemporary with or even anterior to that of human races".

In the Koran, the banana plant is referred to as the paradise tree.

Popenoe states: "There seems little reason to doubt that the banana was one of the first foods of man, and that it was one of the first plants cultivated".

Reference to the banana can be found in the Sacred Books of the East which are generally based upon ancient sources. The banana tree is pictured in early Buddhist art. It is sacred to one of the forms of the Goddess Kali and is especially worshipped on the third day of the month Sravana.

### Some of the conditions under which the banana is grown in Malaya.

The cultivation of the banana in Malaya on a large scale has not until recent years been considered as a paying proposition for various economic reasons. The chief of these has been the high cost of transportation and the limited cultivation of this crop, which has been insufficient for the building up of such an industry as the manufacture of banana flour.

The majority of the banana varieties which are cultivated in this country are indigenous to Malaya and can be grown successfully on most types of soil, below an elevation of about two thousand feet, provided that suitable methods of cultivation, drainage, mulching and irrigation are employed. A well drained fine sandy loam is a satisfactory type of soil for banana growing. One of the largest banana growing districts in the Federated Malay States is on undulating land of about two thousand acres with a rich alluvial granitic clay loam (Plates I and III). It appears that the working basis of the latest and most progressive cultivators is that a 'banana soil' and a 'cultivated soil' will soon be synonymous. This applies more especially to Jamaica where in all probability the cultivation of bananas is carried out more intensively than anywhere else in the world.

At the present time, the growing of the banana in this country is practically confined to the Chinese who control the chief markets such as Penang, Kuala Lumpur and Singapore. Owing to the fact that suitable land for bananas is easily obtained, very little attention is given by the Chinese grower to the question of cultivation, draining, mulching or irrigation of the crop and consequently, after about four to five years, when the soil is in a thoroughly bad state of tilth and the suckers are in an unhealthy condition, the land is deserted and another lease is taken out for virgin land for another period of about five years and so on. The result is that large areas of land, whose soil is in a depleted state, lie scattered throughout the banana growing areas (Plate II).

It seems that it is cheaper for the banana cultivator to grow his crop in this fashion rather than retain his land for an indefinite period and practice suitable methods of cultivation and manuring.

The chief cultural problems in Malaya are lack of humus on the old and more particularly, the hilly lands, and the lack of adequate drainage on the flat lands. The former trouble is due chiefly to the leaching effect caused by the heavy rains and the growing of unsuitable catch crops which are heavy surface feeders, such as pineapples, which are commonly grown by the Chinese as an intercrop with bananas. To increase the humus in the soil, a leguminous intercrop such as ground-nuts, lima beans or velvet beans should be grown in order to prepare the land for replanting. A satisfactory system carried out in Jamaica is to replant a certain proportion of a banana field each year so that every year there is some planting going on. Advantage is taken of this interval to increase the humus in the land by growing a leguminous crop.

## Cultivated Malayan Varieties.

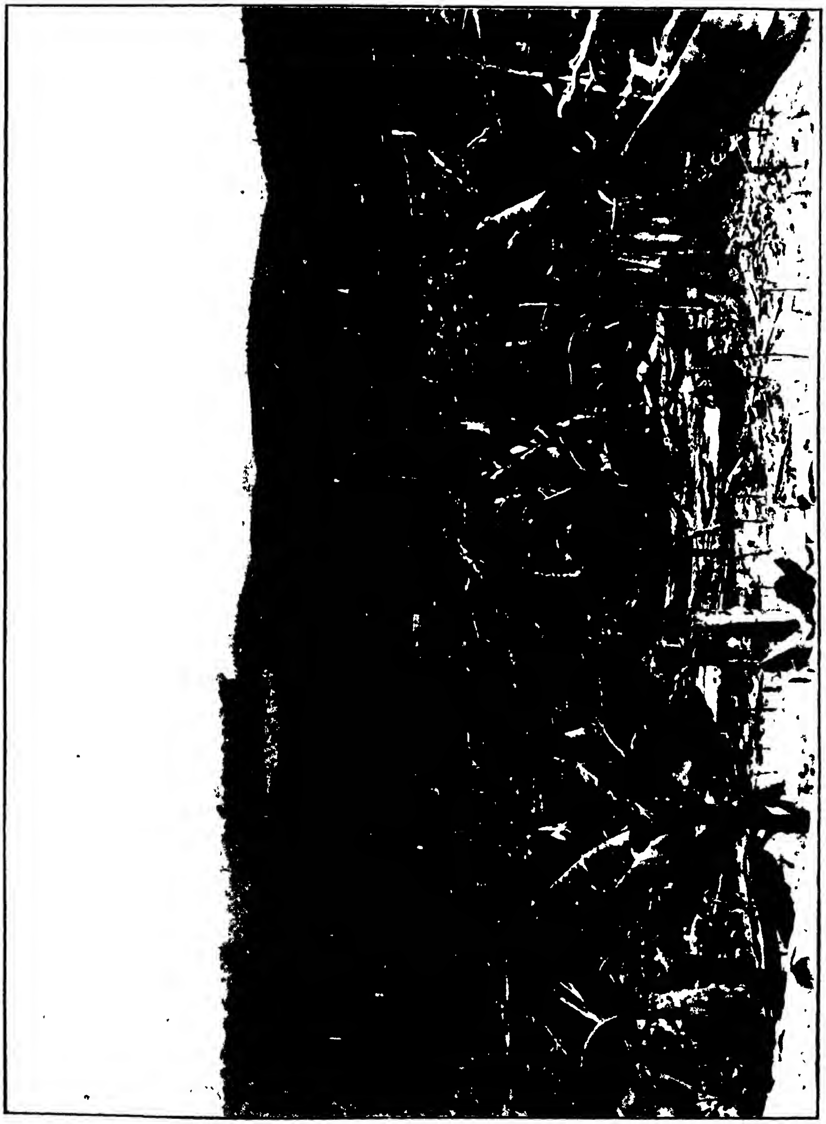
The chief commercial varieties which are cultivated are "Pisang Embun", "Pisang Mas", and "Pisang Restali". Some of the less important banana varieties which are grown are, "Pisang Rajah", "Pisang Mundan", "Pisang Talon", "Pisang Laing", "Pisang Masak Hijau", "Pisang Nangka", "Pisang Awak Legor", "Pisang Awak Betol", "Pisang Serendah", "Pisang Rajah Udang", "Pisang Kapas", "Pisang Abu" and "Pisang Tandok". A few notes on some of these varieties are as follows.

*"Pisang Embun,"* also known as "Pisang Medji" and in Penang as "Pisang Bunga".

This is one of the most popular varieties amongst both Asiatics and Europeans (Plate IV). The hands are evenly spaced and the fingers, which are large, well filled and of uniform thickness, are generally curved in the neighbourhood of the pedicel and lie adjacent to one another throughout the greater part of their length. This variety closely resembles the "Gros Michel" or "Jamaica" banana and is identical with it according to Dr. O. A. Reinking, who has just completed an extensive tour of the East where he made an exhaustive study of the varieties of the bananas found growing there. In some localities, well grown plants attain to a height of fifteen feet. The pseudo-stems are usually mottled considerably with black markings. The leaf sheaths near the point of attachment to the petiole are covered with a white waxy substance in the young stages. The usual number of hands per bunch is about eight to ten and the number of fingers per hand about fifteen to seventeen. The fingers are from six to eight inches in length and one and a half inches in diameter.

*"Pisang Restali."*—The "Pisang Restali" of Malaya is quite a distinct banana from the Restali of Southern India. It is grown a great deal in certain areas only, particularly Western Johore, where an alternative name for the variety is "Pisang Kling" which is different from the "Pisang Kling" in the

PLATE III.



Young banana suckers on recently opened up land in the Jelebu District. At the present time the bananas in this district cover an area of about three thousand acres.

Federated Malay States. These names are suggestive of the variety having been introduced from India at one time or another.

A feature about this variety is that the fruit is not at its best when full yellow but improves in quality and flavour as the skin becomes brown and black. The fingers are generally four to four and a half inches long and one and one quarter inches in diameter; of uniform thickness and ridges not at all pronounced. The skin is very thin, thus preventing it from being a suitable variety for export, and quickly becomes covered with brown spots.

*"Pisang Mas"*.—This variety, known also as the "Golden Banana" (Mas = golden) is regarded by many as the most choice of the Malayan varieties (Plate V). It is cultivated very extensively in some areas by the Chinese and always commands a higher price than other varieties. The fingers are small, not more than three inches long and one and a half inch in diameter and project more or less at right angles to the stalk of the bunch. The skin is very thin, rendering the fruit very liable to bruising. It is unsatisfactory for export purposes owing to the delicate nature of the fruit and its small size and bad shape for carrying.

*"Pisang Masak Hijau"*.—This variety is sometimes known as Pisang Hijau and is characterised by being yellow-green when ripe and never attaining to a truly yellow colour.

The habit of the plant, size and shape of the bunches and fingers, are identical with those of "P. Embun" excepting that in the former case there is a tendency for the fingers to fall away from the bunch at an early stage.

*"Pisang Tando"*, spelt also "P. Tandok".—A large horned variety of banana (generally consumed in a cooked state). The whole bunch has generally only two or three hands, if the cluster is reduced to a single fruit, the latter becomes exceptionally large. The individual fruits are usually about a foot long and two inches in diameter. This variety is common in Borneo and has been found to be the most satisfactory in the manufacture of banana flour.

*"Pisang Rajah"*.—This variety is grown to a fairly large extent but is not so common in Malaya as "P. Embun", "P. Restali", "P. Mas" and "P. Masak Hijau". In Java, however, it is quite one of the most popular and extensively grown varieties. The plant is of sturdy habit—eight to twelve feet in height with a purple marking on the two margins of the leaf petiole. The bunches are compact with generally seven to eight hands and fourteen to sixteen fingers per hand. The fingers have rather a pronounced apex and taper gradually to the pedicel at the base, being usually five to six inches in length. Three or four rather prominent ridges are generally present and the skin is of medium thickness. Ripe fruit is buff in colour with a tendency to retain the green colour slightly along the ridges.

*"Pisang Rajah Udang"*.—This is the only red variety encountered in Malaya. Pigmentation extends throughout the whole plant except the lamina and is particularly noticeable on the pseudo-stem and leaf mid-rib. Bunches with eight to nine hands are common, but no doubt under very favourable conditions

considerably larger bunches might be expected. The fruit is a dark red brown when immature, but on ripening assumes a yellow tinge, particularly when exposed to full sunlight. Ripe fruit is well filled with little or no sign of ridging, five to five and a half inches in length and one and a half inches in a diameter.

This variety is not much grown by the native cultivators in Malaya, no doubt on account of the popular belief among Malays that it causes a skin complaint which affects those who consumes the fruit.

The interesting example of a yellow bud mutant of the red banana ("Pisang Rajah Udang") was observed on a rubber estate in Eastern Johore. From a single plant of the red banana one of the suckers in a subsequent season was found to bear yellow fruit instead of red. Out of interest, the owner removed this sucker and later established other starts from it. Except for lack of pigment throughout, and a slightly paler flesh, this yellow mutant in no wise differs from the original red form.

*"Pisang Serendah"*.—This variety is one of the Cavendish forms (*Musa Cavendishii* Lam. var.) as can be seen from a glance at the dwarfed broad-leaved habit of the plant. This variety is known also as the Chinese or Canary banana.

It is the only representative of the Cavendish species seen in Malaya and may possibly be of fairly recent introduction, as it appears to be by no means widespread throughout the Peninsula, in spite of the excellent qualities of the fruit and the fact that it grows readily. The fruit of this variety does not assume a rich yellow on ripening but remains greenish yellow. Otherwise it is similar to the typical "Canary" banana and is of excellent flavour.

*"Pisang Awak Betol"*.—This variety is interesting in that seeds are frequently found in the fruit. Bunches with ten hands and fifteen to seventeen fruits per hand are commonly found. The fruit tapers to rather a sharp point and is usually three and a half to four inches long and one and a quarter inches in diameter, not unlike "Pisang Restali" in shape. The skin is frequently spotted. Together with "Pisang Awak Legor" the variety is cultivated a good deal in parts of Selangor.

*"Pisang Kapas"*.—The name given to this variety (Kapas = cotton) possibly has reference to the texture of the fruits. The hands stand out at right angles to the rachis and show no signs of curling over until fairly well developed. The feature is all the more noticeable on account of the hands being situated some distance from one another on the rachis. Bunches with nine hands averaging seventeen fingers per hand were seen. The fingers, four to four and a half inches long and only slightly curved, are yellow when ripe with yellow flesh. The lack of compactness in the bunches and tendency for the fingers to stick out, disqualifies this variety from being of any value as a shipping variety. Furthermore, the flavour is not good.

*"Pisang Brok Bakul"*.—This variety is regarded by cultivators as a heavy yielder. The plant is characterised by a certain amount of red or pinkish colouration, noticeable particularly on the mid-rib and leaf petiole. Bunches with eight hands averaging sixteen fingers per hand are common. The fruit,

Showing two mature "Pisang Embun" suckers in the foreground. This variety is interplanted with the "Pisang Mas" in the Jelebu District

PLATE V.

Showing a mature " Pisang Mas " sucker in the foreground, also Pineapple plants which are commonly grown as an intercrop w'th the " Pisang Mas " and " Pisang Embun " Bananas in the Jelebu District.

five and a half inches long, is plump and well filled, with a pedicel about half an inch long. The flesh is pale yellow with a dark area located in the centre.

*"Pisang Abu"* (Abu=ash).—This is a very distinctive variety in that the fruit and the under-side of the leaves are covered with a "bloom" of light coating of a white waxy substance. This substance is the same as that which is found on the so-called "wax banana" which is common in Java, the leaves of which are covered on the under-side with a similar minute white powder. The Javanese scrape this meal together, melt it over a fire, and produce a valuable wax. The wax thus obtained becomes very clear, hard and whitish and forms an important article of trade in middle Java. Bleaching renders it very white. One banana tree (with seven leaves) yields two ounces of wax. As there are thousands and thousands of plants growing in a wild state over large areas, the preparation of the wax is a remunerative enterprise. There are no records of the collection of wax from this variety in Malaya.

The fruit of the "Pisang Abu" is four to four and a half inches long and about two inches in diameter with a yellow skin when ripe and with white flesh. It is regarded as a cooking variety and sub-varieties exist.

*"Pisang Nangka"*.—This is one of the larger cooking varieties and is grown a great deal in Johore. The fruit is eight to nine inches long and up to one and three quarter inches in diameter. The flesh is pale yellow.

*"Pisang Talon"*.—This is no doubt the largest fingered variety in Malaya and is a typical cooking banana. It is very similar to the variety "Nendren," so common on the Malabar Coast in India. Fingers may be almost a foot in length and up to two and a half inches in diameter.

## The Presence of Diseases and Pests.

The banana areas in Malaya are comparatively free from any very serious form of disease at the present time. The disease which has been responsible for the greatest losses is Panama Disease, caused by the fungus, *Fusarium Cubense.* This disease exists only in an endemic state in Malaya and so far it does not show any indication of reaching the alarming proportions which it has attained in Jamaica and in Central America. Unlike most other banana producing countries, Malaya is not limited to one or two important varieties and owing to the fact that there are several good commercial varieties which are not, as yet, affected with Panama Disease, there is no immediate cause for alarm.

The varieties which have proved to be the most susceptible to Panama Disease are "Pisang Embun" and "Pisang Restali," and to a less extent, "Pisang Talon." The first named is the most important commercial variety. All of these varieties show degrees of susceptibility under different physiological conditions, as has been shown by various inoculation experiments. Moisture

is the most important factor with regard to the incidence of this disease, the worst outbreaks occurring during the rainy season, while during the drier weather there is much less evidence of disease symptoms.

The soil organism causing Panama Disease affects the vascular tissue only and internal symptoms of disease are first apparent in the roots or cut end of the sucker and afterwards appear throughout the rhizome and eventually in the above-ground parts. A cross section taken near the base of the pseudo-stem of a diseased plant shows the cut surface with rows of yellow, orange, red or red-brown spots which mark the position of the diseased vascular bundles. The distribution of the diseased fibro-vascular bundles is usually more concentrated towards the central portion of a diseased plant and the occurrence of a central rot associated with the massed bundles is of value in distinguishing Panama Disease from diseases in which the rot extends from the periphery. There may, however, even in Panama Disease, be no development beyond a suffused yellowing and softening of the upper part of the bulb.

Bacterial vascular diseases of the banana exist whose internal and external symptoms are very similar to the Panama Disease. These bacterial diseases are Blood Disease, caused by *Pseudomonas celebensis* and the Javanese Vascular Disease caused by *Pseudomonas musae*. These diseases are met with fairly commonly in the Dutch East Indies but have not yet been found in Malaya. The external symptoms peculiar to Blood Disease are: (1) the yellow stripe effect on the leaves; (2) the particular discolouration occurring on the fruits. In the case of the Javanese Vascular Disease, the typical symptom is the diminutive size of the heart of the crown.

A peculiar form of bacterial wilt affecting only "Pisang Restali" bananas was found in Johore a few years ago. This disease soon disappeared and has not been recorded since. The causal organism is very similar to *Bacterium Solanaccarum* which causes the bacterial wilt of bananas in Trinidad and was investigated by Ashby. The external symptoms of the bacterial wilt disease affecting the bananas in Johore were practically the same as those found in Panama Disease. In the bacterial form, a transverse section of a diseased rhizome showed a yellow-white exudate from the exposed surfaces. The only indication of decay within an affected plant was usually a black ring about half-way between the centre and periphery of the section. Usually there was no red or brown discolouration of the vascular bundles elsewhere.

Periodical outbreaks of the insect pest known as the leaf-roller (*Erionata thrax* L.) occur in most banana areas and often with quite serious results. The defoliation effect is usually sufficiently severe to cause the production of inferior fruit bunches. These outbreaks are largely influenced by the prevailing weather conditions. Dry periods appear to be the most favourable for the spread of this pest. All of the cultivated varieties appear to be equally susceptible to attacks by this insect. The two wild varieties *Musa violescens* and *Musa malaccensis* are not affected.

The banana weevil borer (*Cosmopolites sordidus*) does the greatest amount of damage in areas where there are poor soil conditions. In connection with Panama Disease, it has been suggested by Dr. Wardlaw, the Banana Pathologist at the Imperial College of Tropical Agriculture, that the weevil-borer may be an important accessory factor as regards acting as a wounding agency. Experiments in this country have shown that Panama Disease existing in a particularly endemic and virulent form, the weevil-borer seldom acts as an accessory factor in the spread of this disease. Inoculation experiments also show that the weevil-borer enters into the rhizome of a sucker after Panama Disease has established itself.

# COCONUT RESEARCH IN MALAYA.

BY

A. Sharples,

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and

*Acting Assistant to the Director of Agriculture.*

Up to the time of the formation of the Rubber Research Institute of Malaya, the main activities of most of the research divisions of the Malayan Department of Agriculture were necessarily confined to the investigation of rubber problems. Coconut investigations, however, formed a main line in the Divisions of Economic Botany and Entomology long before the inauguration of the Rubber Research Institute and since 1920 much work has been done on coconut research by the officers of these Divisions. When the rubber work of the Department was taken over by the Rubber Research Institute, other Divisions devoted more time to coconut problems, so that at the present time this crop is receiving a considerable amount of attention as regards research necessities.

In 1920, the Division of Economic Botany commenced taking individual yield records with a view to studying variation in individual palms. In 1922, an Experimental Coconut Plantation of 50 acres was started between Klang and Port Swettenham and planted up with seed nuts of known origin.

The study of variability in coconuts by the Division of Economic Botany up-to-date has shown that as regards fruiting qualities, the co-efficient of variation in the number of nuts produced per annum is as high as 34% of the mean production per palm under average estate conditions. The study of variation has also revealed the fact that 19% of the palms on the average estate are unprofitable. Fruiting characters of individual palms have been found to be definitely constant over a period of eight years and no doubt this constancy also exists as regards the oil content of copra from individual palms within the range of seasonal variation. Investigations on this point are already in hand by the Chemical Division.

The entomological work from 1920 onwards included investigations into the life history of the more important pests of coconut palms and the following special bulletins have been issued.

(1) The Two-coloured Coconut Beetle (*Plesispa reichei*).

(2) Red-Stripe Weevil of Coconut (*Rhynchophorus schach*).

Further considerable work on the Black Beetle (*Oryctes rhinoceros*) and the influence of *Tirathaba rufivena* (Greater Spike Moth) on immature nut-fall has been undertaken.

The study of diseases of coconut palms was under investigation during the days of intensive rubber work but after 1926 this work was considerably acce-

lerated. The work was mainly concentrated on the elucidation of the so-called "Bud-Rot" problem. In 1922, a paper was published in the Annals of Botany describing inoculation experiments which led to the conclusion that the problem had not been finally settled and that, as far as Malaya was concerned, the whole subject needed reinvestigation. Numerous articles on coconut diseases have since been published and in 1928 a special double number of the Malayan Agricultural Journal was published giving the results of the work up-to-date. The important results may be summarised as follows:—

(1) No evidence has been found to support the suggestion that a form of epidemic Bud-Rot, caused by parasitic organisms, exists in Malaya.

(2) That Lightning is of primary importance in the question of so-called Malayan Bud-Rot and probably of other affections.

(3) That *Marasmius palmivorous n.s.* plays a role of some importance in so-called Bud-Rot manifestations in Malaya.

In 1928, a report entitled Copra Manufacture, by H. C. Sampson, was received in which he reviewed the present Empire position with regard to quality of copra and the possibilities of improving the quality, with suggestions as to the relevant lines of research and the place where the work could be best undertaken. The report suggested *inter alia* that "Malaya seems to offer the best scope for carrying out this work for not only is copra becoming of increasing importance as an export from there, but the country probably has better facilities in the way of staff and equipment than is possessed by other colonies interested in this matter. It would be a much better country than Ceylon since the climatic conditions in the main coconut growing districts of that island much more closely resemble those of the West Coast of India where sundrying is largely practised."

As the matter was of considerable (Imperial) importance economically, the Empire Marketing Board, after consultation, expressed their willingness to provide a contribution towards the cost of the Research, an offer which the local administration accepted. The more immediate work on copra research obviously demanded study from the chemical point of view, and arrangements for the special appointment of an Assistant Chemist for Copra Research were made on the initiative of the Empire Marketing Board. The appointment was filled, and this officer assumed duties in October, 1929.

The question of the appointment of a Copra Research Chemist was under discussion when the Director of Agriculture arrived in Malaya in 1929. The Director of Agriculture suggested the formation of a Departmental Copra Research Committee, with the object of correlating the various lines of work in progress, and making suggestions for its extension on properly co-ordinated lines, the Heads of Divisions to sit as members with the Government Mycologist as Chairman. This Committee held its first meeting on April 14th, 1929, and made a number of recommendations relative to the desirability of collecting information on the subject of copra manufacture in Ceylon and the marketing

of copra in England. As a result, the Government on the recommendation of the Director of Agriculture approved:—

(a) of an officer being deputed to obtain information as to the market standards required by copra dealers in England and data concerning other factors influencing the price of copra on the English markets. A report on this subject has been lately submitted by the officer in question (Mr. D. H. Grist, Agricultural Economist).

(b) of an officer being deputed to visit Ceylon with a view to obtaining information relative to manufacture of copra in Ceylon, for purposes of comparative study. Subsequently, a schedule was submitted by the Committe to the Director of Agriculture indicating various additional lines of work which appeared to offer prospects of yielding useful information.

A considerable amount of useful research work on copra had already been achieved by the Chemical Division. This work comprised particularly:—

(a) Analytical comparison of the composition of Malayan copra with Ceylon and Malabar copra.

(b) Studies of variations in oil content of copra from selected palms. This work was being carried on in collaboration with the Economic Botanist.

With reference to (a) the work so far performed appears to indicate that commercial Malayan copra is of lower oil content than copra from Ceylon and Malabar, but this result required confirmation by further analyses. In the opinion of the Acting Agricultural Chemist, the alleged inferiority of Malayan copra may be largely due to climatic causes. Efforts will, therefore, be made to obtain further information on this point by importing seed nuts from Ceylon and Malabar, and by making enquiries in this country to ascertain whether any seed nuts have ever been imported from Ceylon, in addition to those at Klang Experimental Station, the trees from which are not yet in bearing. As a result, a provisional outline programme of work on copra research was formulated as follows. This programme may be subject to modification as experience is gained.

(a) The Assistant Chemist for Copra Research on arrival in Malaya should in the first place undertake a series of tours through the Malayan coconut districts with the object of obtaining a general knowledge of the various conditions associated with the coconut industry. These have already been commenced.

(b) After the preliminary survey, a detailed study of the production of copra stage by stage would be commenced. The following items indicate the more important lines to be followed:—

1. Systematic comparative analysis of native and estate copra from different districts in Malaya, Borneo and Sarawak.
2. Examination of further samples of copra from other countries, e.g. Ceylon and Malabar and a detailed comparison of actual nuts from Ceylon, Malabar and Malaya—also microscopic comparison.
3. Laboratory experiments on the colour of soap produced, and the bleach-

ing properties of coconut oil derived from copra from different sources—these tests are used in the soap and edible oil industry for grading oils.

4. Structural examination, radially and tangentially, of nuts of various shapes, sizes and states of ripeness in order to determine the best sampling position to be adopted in the succeeding work.
5. An elaborated examination including tangentially sectioning of under-ripe, ripe and over-ripe nuts derived from two high yielding and two low yielding palms.
6. The same from a palm yielding uniformly small nuts, and one yielding uniformly large nuts.
7. The same from palms of different ages, and also of different types—in conjunction with chemical analysis of soils and fruits.
8. Thinning out the flowers or young fruit to note the effect on the yield and oil per cent of copra.
9. A study of tapping for toddy, noting its effects on yield and oil per cent of copra.
10. An elaborated study of the structure and growth of coconuts obtained by dating individual nuts, immediately the spathe opens, and by picking individual nuts daily between 200 days and until natural nut fall commences, including microscopic examination and f.f.a. (i.e. free fatty acid) determination.

    The basis of comparison between the individual nuts will be the "ripeness factor" or "total oil per unit area of meat" (Oil % Wet x Thickness of Meat x Sp. Gr. Meat) which will, it is anticipated, effectively overcome individual differences in shape, size, meat thickness and erratic development of the nuts examined. In this connection, neither Total Oil nor Oil percentage (dry) is considered here an effective method for studying nut development.
11. Bulk determination of the total oil derived from 100 ripe ungerminated nuts and 100 partially germinated nuts and 100 young nuts, and the same for nuts kept one, two and four months longer before opening.
12. The preparation of a comparative statement of the picking systems in vogue on different plantations and the copra obtained (quality copra and oil yield per 1,000 nuts).
13. An examination of the working costs of different methods of collection and estate transport and the effect, if any, on the copra obtained.
14. The preparation of a comparative statement of the Capital Cost, Maintenance and Repair Charges, Life of Plant, Labour Costs, Capacity, Speed and Efficiency of existing driers and of the proprietary driers at present on the market.
15. A comparison of the working temperature and humidity conditions; and of the colour, structure and quality of the copra obtained by the existing methods:—Sun-drying, smoke-drying, simple hot air drying,

and chula drying and also of perfect copra obtained on a small scale under laboratory conditions.

16. The effect of washing the meat in water, 2% formaldehyde, hypochlorite or sulphurous acid before drying.
17. The effect of 'sulphuring' during drying.
18. The effect of the size of coconut meat on the rate of drying, and subsequent mould formation.
19. Small-scale experiments in burning coconut shell, using forced draught —consideration of the use of a gas producer as a source of heat.
20. Small-scale laboratory experiments under varying conditions of drying, noting structure and physical condition of resulting copra.
21. The effect on mould formation, of chopping the copra after drying.
22. A study of the storage of the different types of copra from different sources under warehouse conditions, noting variation in oil, f.f.a. and moisture.
23. A study of the maintenance of low moisture content, or its fluctuation under conditions of varying humidity for copra of different physical structure.
24. A study of mould, f.f.a. formation and insect attack under varied conditions of temperature and humidity.
25. A comparison of clean and mouldy copra from the same source.
26. The effect of mixing (on a 25%, 50% and 75% basis) of estate with native copra, noting results.
27. A study of the temperature and humidity conditions in a copra cargo boat with a view to possible improvements.
28. The actual preparation on a large scale of copra containing 72% Oil and a comparison between it and that derived from Ceylon and Malabar, and the working oil and copra yield per 1,000 nuts.

In addition to the above, a considerable programme of research work on coconuts is in hand in the various Divisions of the Department. The following may be mentioned:—

(a) The selection and breeding of improved strains of coconuts.
(b) Manurial and cultivation experiments.
(c) Pests and diseases of coconuts.
(d) Catch crops and cover crops in coconut cultivation.

The preliminary work on the structure of the coconut fruit has been started and although only a few months have been spent on the work, important subsidiary indications have been obtained.

Variation in oil content has been studied in (a) for different nuts and (b) for different parts of the same nut.

The results for (a) show that a considerable variation exists in oil percentage (D.B. = dry basis) in pieces of meat derived from nuts normally picked on Malayan estates as shewn by a range from 45% to 75%. The copra result-

ing, from which the individual pieces were picked, will probably show the same variation; this indicates that there is considerable room for improvement if a more uniform product with a higher average oil content can be produced.

The results for (b) show considerable difference in oil percentages in pieces of meat from different parts of the same nut, most particularly in nuts not fully ripe. This throws considerable doubt on the utility of any nut sampling which has been done in previous experimental work when the state of ripeness has not been specified and when the sampling has been done at random.

Experiments in the selection of the best sampling position have shown it is desirable to take samples near the middle of the nut and not from the ends where extreme differences are found. Further, when tangential slices are examined, an oil gradient has been determined, with the lowest oil percentage on the inside face of the meat gradually increasing in value as slices are taken nearer the shell. In these preliminary experiments, the difference in oil percentage of a 1/10 inch slice of meat from the inside face as against a similar piece nearest the shell seems to show a fairly constant difference of 38%,—40%. This applies only for a ripe ungerminated nut; the meat from nuts containing a germinating embryo does not show this oil gradient.

The effect of ripeness on oil yield has been studied fairly extensively and the results show that there is an increase in oil percentage as the nuts germinate and become over-ripe. In the samples examined, an average increase in oil percentage was found, from 63% when the nuts were considered to be ripe, up to 72% when the nuts held a germinating embryo 3½ inches in diameter. This result confirms the studies made by analysing tangential and radial slices of meat. This finding may have some significance in the question of the apparent superiority of Malabar and Ceylon as compared with Straits copra, if it is correct that, in Malabar, the nuts are allowed to fall naturally, while in Ceylon there is a longer ripening period and the nuts are kept for a considerable period after plucking. The question of whether the total oil in the nut continues to increase after the nut is considered to be ripe has still to be determined, but it appears that the best plucking age will be an important economic factor, if copra should ever be valued according to oil content.

Further work on copra deterioration has been done and it has been shown that badly deteriorated samples of native manufactured copra may show the remarkably high average oil content of 67.2% which is 2% in excess of the average for large good quality samples of Malayan estate copra.

During deterioration it may be accepted that the total oil content is diminished owing to the degradation of the actual oil containing meat. which will result in a net loss in weight of copra, by agencies such as moulds, insects and heat. But it is a fact that such copra when analysed may show a high oil percentage content with usually a high development of f.f.a.

The preliminary experiments have provided very interesting results and confirmatory and extensional experiments are being carried out,

A comprehensive scheme of research work on coconuts has been proposed in Ceylon, and a special research station for this crop is being organised in that country. Copra research work is also being undertaken at the Biological Station, Slough, attached to the Imperial College of Science and Technology, London, and discussions are in progress with a view to establishing co-operation between Malaya and these stations. Every effort will be made to maintain touch with all research stations undertaking coconut research work, as lack of such co-operative effort often leads to unnecessary duplication of effort.

It is proposed that a half-yearly report on the progress of the copra research work will be published and so soon as sufficient experience has been obtained and the work of the Copra Research Chemist has become established along sound lines, definite proposals for the erection of one or more experimental driers will be put forward. The results of completed pieces of research will be published as bulletins of the Department of Agriculture, while summaries thereof will appear from time to time in the Malayan Agricultural Journal.

# REVIEW OF THE COPRA MARKET (OCTOBER 1929).

BY

D. H. GRIST,
*Agricultural Economist.*

## Introduction.

The world's marketed production of copra is estimated to be slightly in excess of one million tons per annum, of which Malaya's exports form nearly 20%. The product is graded on the European market according to the country of origin; the accompanying table indicates the existing grades, the average prices obtained, and the approximate quantities shipped annually.

TABLE I.

*Grades and Values of Copra.*

| Grade | Average price per ton (Nett Cash C.I.F.) London | Average Quantity Shipped per annum (Tons) |
|---|---|---|
| (a) F.M.S. Ceylon ... | £24. 5.0 | 95,000 |
| F.M.S. Java ... | 23.10.0 | 40,000 |
| F.M.S. Straits ... | 23. 7.6 | 180,000 |
| M.S. Straits ... | 22.12.6 | |
| F.M.S. Dutch East Indies ... | 23. 7.6 | 360,000 |
| M.S. ... | 22.12.6 | |
| F.M.S. Ceba ... | 22.17.6 | 200,000 |
| F.M.S. Manila ... | 22.10.0 | |
| F.M.S. South Sea ... | 22.17.6 | 150,000 |
| Kiln dried South Sea ... | 22.10.0 | |
| Average | £23. 1.9 | Total 1,025,000 tons |

In view of what follows, it should be noted that those grades which command the highest price (F.M.S. Ceylon and F.M.S. Java) bear but a small

(a) F.M.S. = Fair Merchantable sundried.

proportion (approximately 13%) to the total quantity marketed; while exports of the high grade Malabar copra have entirely ceased.

## The Decline in the Price of Copra.

A review of the existing condition of the copra market cannot be undertaken without comparing this oil seed with the remaining oils and oil products. During recent years, the price of oils and fats generally has appreciated. Thus, taking the pre-war index price as 100, the average price of oil seeds in August 1929 stood at 137, that of oils and fats at 122, and oil cakes at 155. (It may be of interest to compare these figures with Cereals at 140 and "Sundries"—including such widely dissimilar products as beef and iron—at 119). The only two oil seeds which do not share this prosperity are copra and palm kernels, the figures for which are 90 and 93 respectively (i.e. they are actually below pre-war level). It will therefore be observed that, at present, other oil seeds command a price approximately 50% higher than that of copra, from which it may be argued either that other oil seeds are too expensive or that copra is too cheap. Whichever of these alternatives is correct, the current opinion of many on the market is that copra has about reached its rock bottom price, but that its recovery will be slow.

The decline in price of copra is shewn by the following figures, which shew the average price of F.M.S. Straits Copra C.I.F. London during the past few years.

TABLE II.

*Average Prices (C.I.F. London) for Straits Copra.*

| Year | Price per ton | Year | Price per ton |
|---|---|---|---|
| 1916 ... | £33.13.0 | 1923 | £27.17.6 |
| 1918 (controlled) ... | 45.10.0 | 1924 | 29.15.0 |
| 1919 ... | 52.10.0 | 1925 | 30. 5.0 |
| 1920 .. | 56. 7.6 | 1926 | 28.12.6 |
| 1921 ... | 30.12.6 | 1927 | 27.10.0 |
| 1922 ... | 24.15.0 | 1928 | 26.17.6 |

It will be observed that since 1925 the price of copra has steadily depreciated by nearly 10%.

## Reasons for the Decline.

It should be clearly understood that the fall in the price of copra must be attributed to a number of causes and not to any one cause in particular. It has been asserted that the activities of a combine of crushers, which is said to control the European market to a great extent (especially in edible oils), has brought about the present slump. While there is no doubt that the combine can affect prices, the writer is of opinion that the principal reasons which have assisted their ends were actually outside their control.

During the past decade, there has been a very striking increase in the world's production of edible oils. The part played by copra in this increase is shewn in the accompanying table, supplied by the Empire Marketing Board and based on figures published by the International Institute of Agriculture.

TABLE III.

*World Exports of Copra (in thousands of tons).*

| | 1909/1913 (average) | 1914 | 1925 | 1926 | 1927 | 1928 |
|---|---|---|---|---|---|---|
| British Malaya ... | 4 | 92 | 86 | 104 | 97 | 95 |
| Dutch East Indies ... | 234 | 338 | 335 | 371 | 300 | 431 |
| Philippines ... | 128 | 154 | 145 | 171 | 196 | 254 |
| Ceylon ... | 41 | 88 | 113 | 121 | 99 | 99 |
| South Seas ... | 70 | 139 | 148 | 159 | 159(a) | — |
| Unspecified | 68 | 64 | 80 | 82 | 62 | — |
| Total ... | 515 | 875 | 907 | 1008 | 913 | |

Similar increases have been experienced in the case of oils and fats which compete with copra. The principal competitors at the moment are ground nuts (the exports of which are shewn in the accompanying table), and whale oil.

The future planting of ground nuts will undoubtedly be liable to fluctuation according to the trend of prices.

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(a) Provisional.

TABLE IV.

*World Exports of Ground Nuts (in thousands of tons).*

| | 1909/13 (average) | 1924 | 1925 | 1926 | 1927 | 1928 |
|---|---|---|---|---|---|---|
| British India ... | 192 | 243 | 463 | 444 | 475 | 749 |
| French West Africa ... | 205 | 312 | 444 | 480 | 404 | 386 |
| British West Africa .. | 64 | 139 | 176 | 188 | 160 | 195 |
| China ... | 39 | 196 | 168 | 176 | — | — |
| Unspecified ... | 55 | 102 | 82 | 89 | | |
| Total ... | 555 | 992 | 1,333 | 1,377 | | |

The production of whale oil, which is largely used in the edible oil trade, has made great strides in recent years. Figures of production indicate an increase from 109,000 tons in 1922 to 203,000 tons in 1927 and 226,000 tons in 1928. Production in 1929 is expected to shew a further material increase. There is reason to believe that local copra producers do not realise that whale oil is perfectly suitable for margarine production, and is in no way inferior to copra oil for this purpose. The whaling industry is better organised than ever before and the number of companies engaged in whaling has increased considerably of late. Whale oil at £25 per ton is said to give a profit to the producer of 25%. Little appears to be known of the habits of whales, and it is therefore impossible to compute the apex of production of this class of oil; but it seems reasonable to anticipate that the slaughter of increasing numbers of whales must soon affect the amount of oil available from this source, by reason of the decrease in their population. At present, however, copra oil is quite unable to compete with whale oil for edible purposes. The present slump in glycerine has also had its effect on the price of oils and fats for the production of soap.

## Quality of Copra.

The existing method by which purchasers of copra estimate its value is entirely based upon its appearance to the eye. A visitor to the London Copra Association, a body whose sole function is arbitration between buyer and seller, will find no apparatus for chemical analysis, but merely a long bench in front of a window on which the samples are exposed to the scrutiny of the arbitrator. Although this method may appear unreliable, it should be remembered that it is based upon the experience of the valuer who appreciates the relationship bet-

ween external characters and oil content; and that this relationship is based upon the fact that good appearance indicates careful preparation, with low moisture and free fatty acids content, and therefore a comparatively high oil content. The method has the advantage of enabling large numbers of separate consignments to be marketed without the delay entailed by chemical analysis.

In the valuation of copra by appearance, the following points are taken into consideration:

(a) *Colour.* The colour should be as white as possible.
(b) *Size & Thickness.*—The copra should be thick and should not contain too great a proportion of small pieces.
(c) *Cleanliness.* The copra should be free from extraneous matter.
(d) *Moisture.* Air-dry and free from moulds.

A white copra will produce an oil of good colour. Thick large copra facilitates crushing, and lessens the liability to development of free fatty acid. Moulds are related to a high free fatty acid content and are caused by delay in drying the copra or by subsequent damage by water. Rapid drying is essential for the production of good copra. Moisture causes copra to deteriorate very rapidly; and once it has become wet, although again dried subsequently, the fact remains evident in the poor condition of the copra. Finally, the presence of pests naturally deteriorate the copra.

TABLE V.

*Quality of Copra.*

| Origin. | Percentage. | | |
|---|---|---|---|
| | Oil. | Moisture. | F. F. A. |
| F. M. S. Dutch East Indies ... | 66 | 4 | 0.8 |
| F. M. S. Demerara ... | 69 | 5 | 1.25 |
| F. M. S. Straits ... | 66 | 4 | 1 |
| F. M. S. Jamaica ... | 69.5 | 4 | 1.25 |
| F.M.S. Mauritius ... | 68 | 3.5 | 1.25 |
| F. M. S. Mozambique ... | 67 | 3.75 | 1.25 |
| F. M. S. South Sea .. | 67 | 3.5 | 4.5 |
| F.M.S. West Indian ... | 70 | 1.5 | 4 |
| F. M. S. Ceylon ... | 68 | ? | 1 |

From the above, it will be seen that the object is to judge the copra on points which indicate a low percentage of moisture and a high percentage of oil of good colour, and economy in manufacture.

Table V gives the average quality of copra from different sources.

Samples of Ceylon copra examined by the writer with arbitrators at the London Copra Association were superior in appearance to those of Straits Copra. The meat of the former was thicker and of better colour, it was cleaner, and it had a sweeter smell. The writer is of opinion that thinness of flesh is more frequently than not due to inferior methods of preparation rather than to variety of coconuts, soil or climate. All the genuine sundried copra examined by the writer was thicker than the kiln-dried copra.

## Improvement of Quality by Legislation.

In certain Crown Colonies, attempts have been made to enforce an improvement in the quality of exported copra by means of legislation. The writer is not familiar with the standard of copra exported from these colonies prior to the introduction of such legislation; but, judging from the few samples of copra from such sources seen in London, the writer was not impressed by their present quality, while brokers who were questioned on the subject were sceptical of the effectiveness of these measures.

## Standards of Copra.

As already stated, copra is bought and sold—not on analysis of a sample—but on a standard based on appearance. It should be added that a separate standard has been laid down for each producing country and that there is no general standard. The designation F.M.S. Straits for instance, means Fair Merchantable Sundried Copra from the Straits Settlements or Malay States. It may also apply to copra from the Dutch East Indies re-exported from Malayan ports. In passing, the writer would remark that some of the so-called sundried accepted on the London market appears to be kiln-dried, or a mixture of kiln and sundried copra.

The standard set down for each country of origin represents the average quality of copra received from that country. It should be emphasised that the purchaser of copra, knowing the country of origin of his purchase, sees no sample, but he understands that the delivery will conform to the standard agreed upon for copra of that particular origin. Should the consignment not reach that standard he will arbitrate; but should it be superior to the standard he will naturally have nothing further to say on the matter.

From the above facts it is considered that, even if Malayan planters improved the quality of their copra, there would be no prospect of an immediate corresponding rise in price. All copra dealers state that the quality of copra from the Malay States is satisfactory, and it is therefore evident that copra

of this quality fills a particular demand. It is of course possible either that a local buyer, anxious for high grade copra with which to level up his stocks, may offer a premium for special quality copra, or that a special market for high grade copra might be obtained in Europe by private arrangement. But, generally speaking, the producer can expect no higher price for copra than the standard laid down for the country of origin. It should also be remembered that any improvement in quality would probably involve an increased cost of production, which would not be justified unless a commensurate increase in selling price were forthcoming.

One important manufacturer of edible oil products definitely asserts that the quality of Malayan copra is satisfactory. He points out that modern crushing and refining machinery is competent to deal with medium or poor quality copra, so that it is far less essential than hitherto for copra to be of high standard.

From Tables II and V it will be found that the unit cost of oil from Ceylon copra is 7.35 shillings as against 6.86 shillings per unit of Malayan copra. If crushing and refining plant can effectively and cheaply deal with the latter, it seems probable that the price of Ceylon copra will tend to approximate more closely to that of Malaya. The writer is informed that there are still some factories which prefer the Ceylon product because they are less capable of dealing economically with lower grades. But it is possible that, as old-fashioned machinery is replaced, the present premium on Ceylon copra will gradually disappear, and that an up-grading of Malayan copra will not have a similar effect on its selling price.

Reference to Table I shews moreover, that the proportion of high grade copra is relatively small. This fact, in conjunction with the general satisfaction with Malayan and similar grades, adds strength to the contention that if the standard of Malayan copra were improved and were to approximate to that of Ceylon, there would be no immediate improvement in price. Later, when the market realised that the Malayan product had improved, there would be, not a rise in the price of the improved copra, but a reduction of the premium allowed on Ceylon copra.

Provided that the average oil content of Malayan copra can be definitely raised, even by 2 or 3%, it is possible that a higher price may ultimately be realised. But the evidence at present indicates that such an improvement in quality would not lead to an immediate rise in price. In these circumstances it is unlikely that any proposals for improving the existing quality of copra would find favour with directors or managers of coconut estates in this country.

It may be urged that this report lays undue emphasis on edible oils and ignores the undoubted necessity of vegetable oils for soap making. But the use of oils for edible purposes is undoubtedly the crux of the question, and it is to the increased consumption of edible oils (in such products as margarine and ghee) that one must look for any appreciable recovery of the price of copra generally.

## Prospects of Consumption.

Supplies of copra are at present adequate, and as already stated, other oils are coming on to the market in increasing quantities. Perhaps the most encouraging feature of the present position is the fact that the market has been able to absorb the enormous increase of edible oil which has been thrown on the market. This absorption has certainly been at the sacrifice of price, but the absence of large unabsorbed stocks encourages one in the belief that the oil market will require constantly increasing amounts of oil to keep pace with the ever growing consumption. An important opinion was expressed to the effect that the oil market can easily absorb all production of oils for the next 20 years, as consumption is increasing by leaps and bounds.

## Summary.

The price of copra since the War has not advanced in line with that of other oil seeds. The grades and values of copra are stated together with the approximate annual production of each. The figures demonstrate that there is a relatively small proportion of high grade copra on the market.

The causes for the fall in the price of copra are examined. It is held that the major reasons are purely economic. The two chief reasons for the present low price are the rapid increase in the world production of other edible oils, and in particular, to the strong competition of the whale oil industry.

The methods of judging copra by appearance, and the qualities which are indicated thereby, are stated.

The method of purchasing copra on standards based upon country of origin and not on sample, is explained. It is argued that any improvement in the quality of Malayan copra will not be reflected in an immediate increase in price.

The opinion is expressed that legislation to enforce improvement in the quality of exported copra has not been effective.

## Conclusion.

Owing to the peculiar methods of buying copra on standard, producers cannot hope for any immediate improvement of price for a corresponding improvement of quality. There is probably some scope for copra of good quality —which may command a premium—for grading up native-produced copra. It is extremely doubtful whether any premium obtained, either by private treaty or the recognition of the London market, would be commensurate with the extra cost of production.

For the above reasons, it is evident that the application of any results achieved by research work on the improvement of the quality of copra will not

be altogether easy. It will be necessary to overcome the strong prejudice of the Trade against any change in the present methods of marketing; while, especially in periods of market depression, any suggestion for the improvement in the quality of copra, which may entail additional expense without a corresponding immediate increase in price, may probably be received, in the first instance, with disfavour by producers.

# FILM PROPAGANDA IN RELATION TO THE DEPARTMENTS OF AGRICULTURE AND CO-OPERATION.

BY

J. CORRIE,

*Personal Assistant to the Director of Co-operation.*

Film propaganda has received considerable attention in India, and it was the perusal of an illuminating article* on this subject which planted the germ of the idea in the minds of Co-operative officers in Malaya.

India has recognised the educational value of film propaganda. The 1928 Report of the Royal Commission on Agriculture in India gives an account of the work done in this connection in the Punjab. The Eastern Bengal State Railway initiated a demonstration train which made a tour of Eastern Bengal lasting for about one month. The train was fitted up as a travelling exhibition by the Railway, Public Health, Agricultural, Industries, Co-operative and Veterinary Departments, and by the Indian Tea Cess Committee. Each Department was allotted a bogey carriage, which was appropriately fitted up with pictures, models and samples illustrating its activities. Open air lectures, accompanied by films and lantern slides, were given at each stop. A similar train was arranged by the Government of the Punjab in collaboration with the North Western Railway in December 1927, and made an extensive tour throughout the Province. The Government of the United Provinces provided a demonstration carriage for the use of Mrs. Fawkes, the Secretary of the United Provinces Poultry Association, to assist her in the work of popularising improved breeds of poultry.

In order to aid in their propaganda work, the Madras Agricultural Department has put on the road a travelling motor exhibition. This was considered likely to prove of more use than an exhibition train, such as that used in the Punjab, for the reason that in South India, railways are comparatively few and they do not always pass through the densely populated districts. Moreover, it is only at big towns and centres that facilities exist for halting a train in a siding without dislocating the traffic. It was, therefore, decided to try the experiment of a motor exhibition van which could be taken from village to village in the interior of the districts and brought to the very doors of the *ryots*.

As regards the exhibits which the vans carry, these cover the whole range of the Departments' work. Each is fitted up in a small showcase with a glass front, which fits into its own section, and these can be changed at will depending upon the locality visited and the nature of the exhibition it is desired to give. A large number of posters are carried and these are displayed on boards on the roof and are attached to the front of the counters. Tables and benches are

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* "Films in the Making. An Indian Adventure." London Times, 23rd August, 1928.

formed of the shelves in the centre of the van and these are arranged round it to display other samples, etc. The whole, therefore, spreads out into an extensive display and it takes approximately an hour to get it ready or pack it all up ready to move on.

Ploughing demonstrations, etc., are given at the same time and in the evening, lectures are delivered with the aid of the lantern. The caravan goes ahead and chooses a suitable site and makes the necessary arrangements, advertises the coming of the exhibition, and so on, and in due course the big van arrives and the display is spread out. Halts of one to three or four days are made depending on the size of the place visited and the occasion. Local fairs and festivals are attended and the utmost use is made of all "shandais," conferences and gatherings of all sorts. Two assistants at least, accompany the vans and of course there is a reliable driver for each.

The sequel in this country was that the Co-operative Societies Department of the Federated Malay States produced a film entitled "Thrift and Extravagance"—the story of two Malays, Mat and Idris. One has no hesitation in stating that wherever this film has been exhibited amongst Malay peasants, profound interest has been created and the lessons taught by the film have not been lost upon an impressionable people. The film has also been well received by the Press. The film, which was produced in Malaya, depicts some beautiful scenes of the countryside.

The story illustrates the fortunes of two care-free youths at school, who, growing up, arrive at the cross roads of life. One path leads to a life of laziness and extravagance, the other to thrift and hard work. Mat chooses the former, and is seen rising late, employing coolies to tap his rubber, buying "sarongs" on credit, then jewellery, a bicycle and other things he could not afford, all on I.O.U.'s, eventually going to a Chetty to whom his property is mortgaged. He refuses the invitation of the local co-operative society to join their ranks and, when the need arises, borrows from them. The result is that Mat's rubber land is put up to auction at the instance of the Chetty, and he is driven to a life of hardship in the interior and finds that, late in life, he is faced with the problem of having to start all over again.

The second part of the film deals with Idris, who took the path of hard work and thrift. He is seen tapping his own rubber and ploughing his own patch of paddy, while his wife employs herself usefully in making mats. He refuses the invitations of the "sarong" vendor to purchase "sarongs" on credit, and plods along perseveringly, becoming a member of the local co-operative society and paying his subscriptions thereto regularly. He one day hears of an adjoining piece of rubber land, which an Indian is willing to sell at a low price, and gets his local co-operative society to inspect the land, approve of its purchase and advance him the money to do so. Finally, at about the time Mat is driven in desperation to the "Ulu" Idris blossoms out as a man of some affluence; he builds a nice large house and spends the evening of his days in comfort in the bosom of his family.

Recently a second film has been prepared. The title is "Malaya—the Land of Opportunity". This is the story of two Tamil labourers, Muniandi and Kuppan and their wives. Their ambitions are fired by the tale of a returned "kangany" with the result that they decide to leave their homes in Southern India and venture overseas. The film depicts their careers on Sungei Lumpur Estate; of how Muniandi by thrift and perseverance is promoted to the position of head "kangany" and Chairman of the Co-operative Society "panchayat"; of how he becomes the owner of cattle and provides his parents in India with funds to buy bullocks, ultimately drawing on a substantial sum from his society to go on leave with his family; of how Kuppan prefers the "toddy" shop and by gradual stages descends the road to ruin until he ends in prison. At the time when his more prudent comrade departs on his well-earned holiday, Kuppan is left, poverty-stricken and hopeless, to start life anew.

In any effort directed to better the lot of the "kampong" dwellers, the Departments of Co-operation and Agriculture are natural allies. A conference of Field Officers of the Department of Agriculture and the Rubber Research Institute and officers of the Co-operative Department held on 8th October, 1929, unanimously endorsed this opinion. The Conference also arrived at a significant conclusion. It was of the opinion that tours of a propaganda lorry or lorries should be organised for the display of suitable films, etc. and recommended the formation of a Committee to work out details of the scheme. The production of films by means of miniature cinema cameras only was envisaged.

It is as well perhaps to point out it is not suggested that the proposed travelling van should carry films alone. Exhibition samples prepared by the Department of Agriculture and the Rubber Research Institute might be shown. Facilities might be afforded for the display of coloured posters, illustrating the control of disease, pests such as attack rubber and coconuts, and other points of interest. Excellent posters, diagrams and illustrations of this nature are issued by the Department of Agriculture in the Dutch East Indies. Leaflets in Malay and Tamil might be distributed.

An aviculture film, such as was lately featured in Singapore by the Malayan Poultry Farm Association, might be borne in mind. Experiments in the breeding of pedigree cattle have already been instituted at Fraser's Hill and Serdang by the Department of Agriculture. It is not too much to say that wide possibilities are opened up by judiciously directed films and other propaganda for the breeding of better class poultry, goats and cattle. The distribution by the travelling van of improved and tested strains of "padi" seed is yet another possibility.

Investigations of cost have already been made from which it can be confidently claimed that compared with the results to be achieved, the cost would be infinitesimal. Films, and incidentally, wireless broadcasting—the inception of which in Kuala Lumpur is foreshadowed at the time of writing—are everywhere recognised to-day as most potent and helpful media of education. It is therefore to such means as these we turn, in order that the lessons to be learnt from science and economics may be brought home to the "rayat."

# THE MALAYAN BUFFALO.

*The following is abstracted from an Official Memorandum on "Rinderpest in Pahang" by Mr. R. Macgregor, M.R.C.V.S., Government Veterinary Surgeon, Pahang West.*

This breed of animals has reached Malaya via Siam. Large numbers are imported annually both for the cultivation of padi, and slaughter for the supply of beef. They do not breed freely in Malaya, the cause probably being more from neglect in care and feeding than unsuitability of climate. The gestation period is roughly ten months, the calving season being from July to September. They have more compact bodies and are shorter limbed than the Indian buffalo, and in both sexes have wide spreading broad horns in contrast to the short curled horns of the Indian buffaloes. The tongue is short and pointed. They do not bellow, a slight squeal being their only call. The testes are carried high and lie longitudinally against the body.

The predominating colour is black but a few animals have a pinkish skin and whitish hair. The mature animals are practically hairless, but the calves are, however, covered with hair, being similar in all these respects to the Indian buffalo.

The Malayan buffalo is essentially a swamp animal and is used principally for puddling low-lying land, preparatory to padi (rice) planting. The Malay regards the animals as his mainstay in the preparation of land for rice growing; the production of meat for the local market apparently he never considers. He only kills an animal on special occasions such as festival days. Ordinarily he demands such a price for his buffaloes that they cannot compete with the imported Siamese stock for beef purposes.

After the padi is planted, the buffaloes are often prevented from going into swamp areas; they are thus deprived of their natural pasturage and their water holes for wallowing. For these reasons they rapidly lose condition and such treatment is bound to have a retarding effect on their breeding.

If it is impracticable to permit the animals access to water holes or swampy land for fear of damage to the growing crop, then it is necessary to throw water over them twice daily and ensure also that they have sufficient fodder to maintain their condition. A little concentrated food would in all probability be economical to feed under the above conditions, as by maintaining the animals in fair condition they are far more likely to breed.

The buffalo is used extensively by Chinese wood-cutters for hauling timber from the jungle. Such work is suited to them as it is performed in the close humid atmosphere of the jungle; further, they can exert a heavy pull on soft ground.

The Chinese, who use these animals for hauling timber, usually spend time and money on their welfare and ensure that their stock have sufficient fodder and often supplement it with concentrated foods. Such animals may be observed to be in prime condition and are capable of hauling heavy logs of timber.

They have the reputation of being more immune to Rinderpest than those owned by Malays. If they do become affected they are reputed to have greater powers of resistence. It is more likely, however, that they are less liable to become affected as they are often stall-fed or kept confined to small areas, whereas the buffaloes owned to Malays are permitted to ramble about the country-side, uncared for, in poor condition and far more likely to pick up any disease

In conclusion, it may be remarked that the Chinese owner of buffaloes has realised that his animals repay him for the extra care and attention he bestows on them. There is little doubt that the Malay owner would obtain a far greater output of work and a faster increase in growth and numbers of his herd if he would devote the ordinary care that it is necessary to give to domestic animals.

# SELECTED ARTICLES.

## CINCHONA IN THE BRITISH EMPIRE.*

The value of the cinchona tree (*Cinchona Ledgeriana*) as a source of quinine is common knowledge, but the considerable work undertaken by British medical officers in the past in making use of the product of this tree as a preventive against malaria is not so well known. The cinchona tree was introduced into both India and Java between the years 1854 and 1864. Prior to about 1880, the world's supply of cinchona bark was obtained from the native forests in Ecuador, Bolivia, and Peru. It was only after the export of bark from these regions could no longer be relied upon that attempts were made to grow cinchona elsewhere. The British were amongst the first to succeed in bringing the tree under cultivation. The pioneers were such men as Weddell, Hasskarl, Markham, Ledger, and others, and it was by their efforts that the establishment of important supplies of the drug became a practical proposition.

The early attempts to cultivate the cinchona tree met with considerable success, and private persons took up the business as a commercial proposition. In the early days of cultivation, experiments were made in India, Burma, Ceylon, Malaya, the Sudan, Jamaica, Trinidad, St. Helena, Mauritius, Australia, and New Zealand; but these experiments were not always followed up to a definite conclusion. In Ceylon and India the efforts were successful, but private planting was soon given up and the Government has been mainly responsible for the supplies. Within the Empire, therefore, at the present day, India is the only country where cinchona is grown on a large scale. There are Government plantations in the Nilghiris in the south, in the Darjiling district in Bengal (perhaps the best known), and a more recently developed one in Burma. There are also quinine factories both in the Bengal and Madras Provinces.

A recent paper by Dr. J. M. Cowan, of the Indian Forest Service and officiating Director, Botanical Survey of India, and Superintendent of Cinchona Cultivation in Bengal, entitled "Cinchona in the Empire: Progress and Prospects of its Cultivation" (Empire For. Jour., vol. 8, No. 1 (1929), discusses the present position of the cinchona and the future prospects of its cultivation.

The enormous importance to the human race within the Empire of the perpetuation of supplies of quinine will become evident when the question of malaria prevention is considered. We have within the Empire a large proportion of the malarial tracts of the world. Prof. Muller of Cologne estimates that some 800,000,000 people suffer from malaria; and according to Sir Ronald Ross there are 2,000,000 fatal cases every year. It is further estimated by Dr. Andrew Balfour that the direct loss sustained by the British Empire due

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* Reprinted from "Nature," Vol. 124, No. 3136 of December 7, 1929

to sickness and death caused by malaria is in the neighbourhood of between £52,000,000 and £62,000,000 per annum.

Apart from financial considerations, it will be apparent that the responsibilities of the British Empire in this question of malaria prevention or reduction are heavy. The question has become an international one, and an organisation for anti-malarial work has been set up by the League of Nations. The policy of this organisation is primarily the quinisation of affected populations. Hence the cultivation of the cinchona tree becomes a question of first importance. It is to a consideration of this matter that Dr. Cowan's paper is devoted.

In India, then, the cultivation of cinchona is confined to Government activities. It was not until 1910-11 that a similar problem had to be faced in Java. Conferences were held, and manufacturers in Holland and growers in Java came to an agreement by which profits were to be shared and by which prices could be maintained at a level which would show satisfactory returns. The disaster which threatened the Java plantations was averted to a great extent by the adoption of this policy; and supplies are now available for the world demands. That the action taken in Java was thoroughly practical, a comparison between the two countries readily demonstrates. They commenced to give attention to the question about the same time and the facilities in both regions were abundant. Yet Java now produces well over 90 per cent of the world's supply of cinchona bark and India only 4 per cent. A very small percentage of the bark utilised comes from South American forests. The production in India represents only about one-third of the amount actually consumed in the country itself. She is therefore at present not only unable to supply her own demands but also, in common with the rest of the world, is dependent upon the Dutch plantations in Java.

Dr. Cowan explains one of the problems which has so far guided the cultivation of cinchona. "It is a well-known fact that to grow cinchona on the same land for a considerable number of years is a difficult and hazardous undertaking, for the first crop, in some manner not altogether understood, renders the soil, at least temporarily, incapable of producing a satisfactory second crop. As long as there is an unrestricted area of forest land the above factor seems of little consequence, but it makes itself felt more and more as the years go on and there is an increasing shortage of land carrying virgin forest."

Dr. Cowan discusses the methods of growing the crop, for details of which the inquirer is referred to his paper. Harvesting the bark commences in a block from about the fourth year, the material consisting of prunings and thinnings. The crop is reaped, the trees being uprooted so as to obtain the maximum of bark, in about the tenth year. The bark is removed, dried, stored, and then passed on to the quinine factory.

Two problems, in the author's opinion, demand urgent solution: the first is to find additional suitable land, an investigation in which other parts of the Empire should join; and the second is to enhance the output per unit of area.

Research work is also necessary with regard to particular strains which yield high percentages of quinine.

The price of quinine at present is very high—£1.9.6 per lb.—so high as practically to prohibit extensive anti-malarial measures. On this subject the Royal Commission on Agriculture in India in its report (1928) stated: "If India is to embark on any large campaign for fighting malaria, we are convinced that it will be first necessary to reduce considerably the price of quinine within India, and this can only be effected if India is self-supporting in production. To achieve this self-sufficiency a considerable extension to the present area under cinchona will we required................. We are satisfied that, in view of the great importance of extending cinchona cultivation and cheapening quinine, much more scientific investigation is called for than has been undertaken in the past."

Dr. Cowan has done well in summarising the present position and in pointing out the great importance to a large section of the human race of the development of quinine production.

# CHEMISTRY AND PLANT DISEASES.*

### A Paper read before the Society of Chemical Industry.

At the monthly meeting of the London Section of the Society of Chemical Industry, held at Burlington House, London, on Monday, Mr. H. Martin (Research Chemist at the South Eastern Agricultural College) read a paper on "Chemistry and Certain Problems of Applied Mycology."

Mr. Martin pointed out that the applied mycologist, who was concerned with the control and prevention of plant diseases, was confronted by a host of problems to which he must turn to chemistry for a solution, problems which to the chemist were unique in their diversity and interest. Hitherto the economic importance of applied mycology had not generally been realised; and it was naturally difficult to arrive at an estimate of the loss caused by the disease in crops, although it was extremely large. From the utilitarian point of view, applied mycology offered a field of profitable research, but co-operation with chemistry was essential for the successful evolution and adoption of the majority of control measures employed.

### Fungicides.

The most important application of chemistry in applied mycology to-day was the use of fungicides to prevent plant and crop disease, and the industrial chemist would, of course, be interested in the commercial possibilities of fungicides. The extent of the market for such products was illustrated by figures from the French wine-growing districts, where the utilisation of fungicides had reached a high pitch of perfection and had become part of the general routine. It was estimated that the annual consumption of copper sulphate used for fungicidal purposes in these districts amounted to 100,000 tons having a value of £2,500,000.

By hit or miss methods fairly satisfactory copper preparations had been evolved which fulfilled the obvious requirements of a fungicide—namely that the spray should cause no injury to the plant but yet retain its toxicity towards the fungus. Copper sulphate itself would not only cause injury, but would fail as a protection because of its rapid removal by rain or dew, and these objections had been overcome by the employment of the basic precipitates produced by adding certain alkalies to the copper sulphate solution. Millardet, for instance, employed lime for this purpose, and the Bordeaux mixture finally evolved from his and Gayon's trials was still the most popular of the copper containing sprays. Ordinary washing soda had also been added, the resultant mixture being called soda, Bordeaux or Burgundy mixture.

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* Reprinted from "The Chemical Age," Vol. xxi, No. 545, December 7, 1929.

## Technical Details of Preparation.

The preparation of these mixtures, however, was a troublesome process, and owing to the rapid loss of adhesive properties of the precipitate owing to crystallisation, it was advisable that the mixing should be done immediately before use. There was, therefore, an urgent demand for a substitute which by mere addition to the spray tank would obviate these difficulties. Attempts to produce such a product as, for example, the Borderite paste introduced by Pickering, the basic copper chloride recently re-introduced in Czechoslovakia, and certain copper-containing powders prepared by the interaction of copper with sulphonated residues of oil purification or with alkaline extracts of lignite, had met with but partial success.

In America, where the use of dusts as distinct from sprays had progressed remarkably in recent years, it had become usual to employ mixtures of mono-hydrated copper sulphate and hydrated lime. These so-called copper-lime dusts possessed many practical advantages, but had not proved as effective as ordinary Bordeaux mixture. It would therefore appear that the successful derivation of the desired substitute would only follow a more fundamental knowledge of the action of Bordeaux and Burgundy mixtures upon the parasite and plant.

An examination of the work done in the past upon the fungicidal properties of sulphur mixtures revealed, in certain aspects, a state of chaos from which a few important conclusions had emerged, but there was an almost complete ignorance of certain fundamental points. The problem was reduced to the consideration of the means whereby the action of the sulphur was brought about, and various hypotheses have been put forward suggesting that an oxidation process occurred before fungicidal action was possible. Directly opposed to this, however, was the discovery by Barker of the formation from sulphur, dusted on the leaves of certain plants, of a compound giving the reactions of hydrogen sulphide. This observation had been followed by the demonstration of the toxicity of hydrogen sulphide to fungus spores in general.

## The Behaviour of Sulphur.

At Wye, work had been concentrated more upon the fact that contact with the fungus seemed all-important, and, as the result of the study of the action of sulphur on copper, it was suggested that hydrolysis was concerned in its fungicidal action. If this hypothesis be accepted, it followed that a fungicidal sulphur compound was formed as the result of the hydrolysis. The mechanism of the reaction of sulphur with solutions of alkali and alkaline earth hydroxides was not fully known, but undoubtedly hydrogen sulphide was an initial product. The end products of the sulphur reaction were, on the other hand, well known and the products obtained by the interaction of sulphur with alkaline hydroxides were standard fungicides.

Work just concluded seemed to establish that the fungicidal factor in these substances was sulphur in polysulphide form. By this was meant sulphur combined in sulphide form in excess of that required to form the normal sulphide. Work upon hops showed that the action of the solution upon mildew was determined solely by the content of polysulphide sulphur. There were theoretical reasons for believing that the protective fungicidal action of these spray materials was likewise governed by their content of polysulphide sulphur, but even if the practical demonstration of this probability be delayed, the work on hops was of obvious and immediate benefit, both to producer and consumer. The grower would always be certain of getting a satisfactory fungicide, and the chemist would know at what to aim in the manufacture of these products.

# IMPERIAL AGRICULTURAL BUREAUX.

It is of interest to note that the Half Yearly Report of the Director of the Imperial Bureau of Mycology has just been issued. The general work of the Bureaux has consisted in examining specimens from 25 Dominions, States and Colonies, besides specimens from the Rubber Research Institute of Malaya and the Scientific Department of the Indian Tea Association.

Inquiries regarding citrus diseases in Palestine have been dealt with and close touch has been maintained with work on diseases of oranges and grapes for export.

Further important work has been done on gumming and leaf-scald diseases of sugar-cane. This is the worst cane disease in Australia and probably Mauritius, and is spreading in the West Indies.

Work on Bacterial disease of cotton in Tanganyika; on Bacterial wilt of plantains and bananas; on Panama disease in collaboration with Malayan workers; on diseased tobacco specimens from Uganda; on tropical species of Phytopthora; on potato diseases from Cyprus; on *R. bataticola* on causing a serious root-rot of oranges in South Rhodesia were also dealt with.

Other work, not so closely connected with Tropical crops was undertaken, but the above digest gives an idea of the wide and all-embracing character of the work undertaken by these Imperial Bureaux.

A visit to the West Indies was undertaken by one of the officers on the staff of the Bureaux, Mr. S. F. Ashby, to advise on certain phytopathological matters.

This Bureaux also organises a Mycological Conference which is held quinquennially. The last Conference has just concluded and was attended by two representatives from the Department of Agriculture, Straits Settlements and Federated Malay States.

The question of Imperial Bureaux formed one of the main subjects of discussion in plenary session at the Imperial Agricultural Research Conference held in October, 1927. The need for the centralization and distribution of information on agricultural subjects had long been recognised and owing to the great measure of success attained in this respect by the existing Imperial Bureaux of Entomology and Mycology, the Conference fully endorsed the proposal that the system of Imperial Bureaux should be extended to cover as many branches of Agricultural Science as possible. The following article* traces the steps which have led to the present stage of development and describes the new organisation.

### The Bureau of Hygiene and Tropical Diseases.

Imperial Bureaux of use to agriculture had their origin in action taken by the Colonial Office in 1908 and 1909. In 1908 that Department established

* Imperial Agricultural Bureaux. W. R. Black, M.B.E., B.Sc. Journal Min. of Agriculture. August, 1929.

the Sleeping Sickness Bureau for the collection and dissemination of information respecting African Sleeping Sickness to medical officers in the Colonies and Dependencies concerned and to investigators engaged in research. In 1912, the scope of this Bureau was widened to embrace all diseases in the tropics both of men and of domestic animals, and it became the Tropical Diseases Bureau. A further development took place in 1926 when, with the publication by the Bureau of a new bulletin of hygiene, its name was changed to the Bureau of Hygiene and Tropical Diseases. The main function of the Bureau as regards tropical diseases is to collect from every possible source information concerning their progress, recognition, prevention and treatment; to collate, condense and where necessary translate this information and to render it accessible to investigators, and to medical and veterinary officers in the tropics with as little delay as possible. The three serial publications of the Bureau are the 'Bulletin of Hygiene', the 'Tropical Diseases Bulletin' (both issued monthly) and the 'Tropical Veterinary Bulletin' (issued quarterly). The two former are concerned chiefly with man, but deal fully with those diseases that are shared by man and his domestic animals; the 'Tropical Veterinary Bulletin' concerns itself entirely with veterinary science. It is intended that this last-named Bulletin shall be taken over in due course by the newly established Bureau of Animal Health (see below). Apart from these publications the Bureau has a valuable library which is open to medical men and others who come to this country from other parts of the Empire. The Bureau is maintained by a grant from Imperial funds and from funds provided by Dominion and Colonial Governments; contributions are also received from the Sudan and certain Indian Provincial Governments. The Bureau is under the control of an honorary managing committee appointed by the Secretary of State for the Colonies. It is housed in the premises of the London School of Hygiene and Tropical Medicine.

## The Bureau of Entomology.*

The second of the Imperial Bureaux of service to agriculture had its origin the year after the Bureau first described. In 1909, the Colonial Office set up the Entomological Research Committee to further the study of entomology in tropical Africa. In 1919, the scope of the Entomological Research Committee was extended to cover other parts of the Empire, and the Committee was merged into a new Imperial Bureau of Entomology. Contributions are received by the Bureau at the present time from the British Treasury and from practically all the countries of the Empire. The Bureau issues three publications: 'The Bulletin of Entomological Research,' containing original articles on economic

* Fuller information regarding the work of the Bureaux of Entomology and Mycology and the Royal Botanic Gardens, Kew, will be found in a volume entitled 'Facilities for Advanced Study' and 'Research in Agricultural Science and Cognate Pure Sciences in the United Kingdom', to be obtained, price 1s net, post free, from the Ministry of Agriculture, 10 Whitehall Place, London, S.W. 1.

entomology; 'The Review of Applied Entomology,' which reviews all current literature on economic entomology throughout the world and is published in two series (a) dealing with insect pests of cultivated plants, and (b) dealing with any insects, ticks, etc., conveying disease or otherwise injurious to man and animals; and 'The Zoological Record' (section Insecta), which contains annually as complete a record as possible of the literature of the previous year, chiefly from the systematic standpoint. In addition to its work of centralising and distributing information, the Bureau undertakes the identification of insects. Under its ægis, Imperial Entomological Conferences are held from time to time. In 1926, the work of the Bureau was further extended by the establishment from the Empire Marketing Fund of a parasite laboratory for breeding beneficial parasites for export to various parts of the Empire for the control of insects which are injurious to agricultural plants, stock, etc. The parasite laboratory (the parasite "zoo") is situated at Farnham House, Farnham Royal, Buckinghamshire. The Bureau is administered by an honorary committee of management, the Chairman and members of which are appointed by the Secretary of State for Dominion Affairs and the Colonies. The headquarters of the Bureau of Entomology are housed in the Natural History Museum and the Library and Publication Office are at 41 Queen's Gate.

## The Bureau of Mycology.*

The third Imperial Bureau to be formed was the Imperial Bureau of Mycology, which came into being in 1920 following a resolution passed by the Imperial War Conference in 1918. The funds of the Bureau are obtained from contributions by the Dominions, India, the Sudan, Iraq, and most of the Colonial Dependencies. The British Government does not make any direct financial contribution, but by arrangement with the Ministry of Agriculture and Fisheries the Bureau at present occupies a Government building at Kew, rent free. A new and more commodious building for housing the Bureau is in course of erection near the Herbarium at Kew, part of the cost of which is being met by a grant from the Empire Marketing Fund. For the purpose of dissemination of information, the Imperial Bureau of Mycology publishes 'The Review of Applied Mycology,' which gives a monthly survey of all current literature dealing with phytopathology and economic mycology from every part of the world. The Bureau arranges periodical Imperial Mycological Conferences; it undertakes the identification and study of fungous and bacterial plant pathogens; and it maintains a museum of tropical plant diseases, and a lending library for the use of overseas mycologists. Like the Imperial Bureau of Entomology, it is administered by an honorary committee of management appointed by the Secretary of State for Dominion Affairs and the Colonies.

* See footnote, page 99.

## Royal Botanic Gardens, Kew.*

Kew fulfills the functions of a Bureau of Botany in all its aspects. On the economic side it has for many years been actively engaged in obtaining from all parts of the world plants of potential economic value, and in the propagation and distribution of these for experimental cultivation in the Dominions and Colonies. Funds have recently been placed at the disposal of the Ministry of Agriculture by the Empire Marketing Board to enable Kew officers to visit overseas parts of the Empire to advise the Governments concerned on botanical and agricultural problems. A botanical survey of the Empire, the fundamental basis for the development and exploitation of the natural vegetable resources, has been continuously in progress for upwards of three-quarters of a century.

The Governments of India, the Union of South Africa, and the West African Colonies maintain officers at Kew for the study of the botanical problems of these particular areas, and negotiations are in progress for the interchange of scientific staff between Kew and other parts of the Empire.

## Imperial Institute.

The operations of the Imperial Institute must also receive mention. It carries out valuable work (a) by investigating Empire raw materials (plant, animal and mineral) in order to determine their possible uses and value; and (b) by supplying technical and commercial information relating to such materials. Special Advisory Councils and Committees have been appointed to deal with plant and animal products and with minerals. The Institute publishes a Bulletin which records progress in agricultural, mineral and other industries, with special reference to the utilisation of the raw materials of the Dominions, Colonies and India; it also issues handbooks and other publications on specific products.

## The Eight New Bureaux.

The question of the extension of the system of Imperial Bureaux was raised at the Imperial Conference of 1926. The Research Special Sub-Committee of that Conference in referring to the great value of the work of the existing Imperial Bureaux, suggested that further Bureaux of a similar kind might well be established in other sciences, as the need for them is realised and the constituent parts of the Empire agree to their establishment. Again, the Committee on Agricultural Research and Administration in the non-self-governing Colonies, which reported in 1927, thought that the establishment of special Bureaux for plant breeding and soils on lines similar to existing Bureaux would be of great value. As a result of these recommendations, the question of the

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* See footnote, page 99.

development of the system of Bureaux was made one of the principal items for discussion at the Imperial Agricultural Research Conference in 1927. That conference recommended the establishment of three further institutions with the title of Imperial Bureaux; for Soil Science, Animal Nutrition and Animal Health; and five further institutions on a smaller scale with the title "Correspondence Centres" to deal with animal genetics, agricultural parasitology, plant genetics (crops and herbage plants) and fruit production; and it also recommended the Centres at which these institutions, with the exception of the Imperial Bureau of Animal Health, should be placed. The Conference considered that the functions of an Imperial Bureau or Correspondence Centre should be to collect, collate and disseminate information of a scientific and technical character; to reply to inquiries on scientific and technical problems from agricultural departments and scientific workers in any part of the Empire; and particularly to facilitate intercourse among group of workers on closely allied problems. On the other hand, it was not considered that the establishment of additional laboratories for attacking imperial problems should form part of the Bureaux organisation.

As regards the administration of these new Clearing Stations, it was recommended that funds contributed for the purpose from the various countries of the Empire should be administered by an authority representative of the contributing Governments. Further, it was recommended that each Bureau should be advised by a technical committee of experts including overseas experts (nominated by the Governments concerned), which should report to the financial supervisory body for the Bureaux.

As a result of these recommendations representatives of the interested Governments met in November, 1928, and drew up a scheme for the establishment of the new Clearing Stations of information, the scheme dealing with the functions and funds of the Centres, the administration of the scheme, the number and location of the Centres, their staffing, accounts, etc., and the rendering of technical advice on the conduct of the Centres by specialists in different parts of the Empire. The recommendations of the Imperial Agricultural Research Conference, 1927, as regards the number and location of the Centres, were confirmed, the Bureau for Animal Health (the location of which was left undecided by the Conference) being placed at the Veterinary Research Laboratory of the Ministry of Agriculture at Weybridge. It was, however, decided to make no distinction in title between the Centres and all the new Centres were designated Imperial Bureaux. These new Bureaux and their location are accordingly as follows:—

| *Names.* | *Location.* |
|---|---|
| The Imperial Bureau of | Attached to the |
| (1) Soil Science ... | Rothamsted Experimental Station, Harpenden, Herts, England. |
| (2) Animal Nutrition ... | Rowett Research Institute, Bucksburn, Aberdeen, Scotland. |

(3) Animal Health ... Veterinary Research Laboratory, Weybridge, Surrey, England.

(4) Animal Genetics ... Animal Breeding Research Dept., Edinburgh University, Scotland.

(5) Agricultural Parasitology ... Institute of Agricultural Parasitology, Near St. Albans, England.

(6) Plant Genetics ... Plant Breeding Institute, Cambridge University, England.
For crops other than herbage plants.

(7) Plant Genetics ... Welsh Plant Breeding Station, Aberystwyth, Wales.
For herbage plants.

(8) Fruit Production ... East Malling Research Station, East Malling, Kent, England.

While all were described as Bureaux, however, it was decided to organise the first three Bureaux above for the present on a larger scale than the remaining five. The purposes of Imperial Agricultural Bureaux were defined as follows: "To act as effective Clearing Houses for the interchange of information of value to research workers in agricultural science throughout the various parts of the Empire, and for this purpose they should maintain an index of research being carried out in different parts of the Empire and as far as practicable in foreign countries; they should begin by collecting, abstracting and collating information from all sources bearing on the most important problems under investigation in different parts of the Empire; they should keep themselves informed of the general progress of research work within their respective provinces in different parts of the Empire; and they should in appropriate cases summarize available statistics where these are of importance in connexion with their work."

As regards the distribution of information it was laid down that Bureaux should on request supply information within the scope of their work to officials and advisory officers in all parts of the Empire, and should on request also, where possible, supply information to research workers in the Empire, such information to include bibliographies and photo-stat prints of articles on specific problems. As regards the general distribution of information it was recognised that special monographs would have to be published from time to time and that it might ultimately be found desirable to establish a journal when a Bureau had become fully established. The recommendation of the Imperial Agricultural Research Conference, 1927, that a Bureau should not undertake any laboratory or field work involving expense was confirmed, but it was realised that a Bureau would be in a position to be of service to research workers in various other ways and especially by facilitating exchange of workers and meetings of workers interested in the same problems in different parts of the Empire, and the exchange of experimental material for research purposes; and by supplying in-

formation on the best centres for post-graduate study, the best sources of supply of apparatus or equipment, etc.

## Funds for the New Bureaux.

An agreement was reached as to the contributions of the Governments of the Empire towards the cost of the new Bureaux.

## Executive Council.

As a result of the decisions of the meeting, an Executive Council for the administration of the new Imperial Agricultural Bureaux has been appointed by the Governments of the Empire on the general lines suggested by the Imperial Agricultural Research Conference 1927. The Council controls the fund for the Bureaux, and its distribution among them, and supervises generally the work of the Bureaux. The Chairman of this Executive Council is Sir Robert Greig, of the Department of Agriculture for Scotland, and the Vice-Chairman is Mr. F. L. McDougall, of Australia House.

## Officers of the New Bureaux.

The head of the Research Institute to which a Bureau is attached has been constituted in each case *ex officio* Director of the Imperial Bureau, and in the case of each Bureau there will be at least one whole-time officer, paid from the Council's funds, who will be the Deputy-Director or the Chief Assistant for Bureau work.

## Official Correspondents.

In place of the scheme of the Imperial Agricultural Research Conference, 1927, for technical advisory committees, specialists in the appropriate sciences are to be nominated as official correspondents for each Bureau by the Governments represented on the Executive Council; and in each country the representative of the Bureau will be the official correspondent to whom the Director of the Bureau may turn for such help as he may require, and from whom he may obtain suggestions regarding the work and activity of his Bureau. It is expected that these correspondents will take a lively interest in the work and functions of the Bureau and facilitate its activities in the interest of the research workers in the Empire as a whole.

## The New Bureaux in Operation.

The scheme outlined above has been accepted by the Institutions concerned, and has also received wide acceptance from the different Governments of the

Empire. Six of the new Bureaux are now functioning and the remaining two will be established shortly.

The writer is indebted to the directors of the older Bureaux, of Kew, and of the Imperial Institute; to the Colonial Office; and to the Chairman and Secretary of the Executive Council for the newer Bureaux for suggestions which have been incorporated in this article.

# ABSTRACTS.

## EXPERIMENTAL CONSIGNMENTS OF PINEAPPLES.

The Empire Marketing Board has assisted the Zanzibar Government in the experimental shipment of fresh pineapples to the United Kingdom. The account of shipments made are contained in an interesting Report which encourages one in the belief that experiments on a small commercial scale on the lines of these shipments might be attempted with advantage. In view of the fact that the time from the picking of the fruit to its arrival in London was about forty-two days, these results are of interest in Malaya as shipments from Singapore would probably take about the same period of time. Omitting consideration of the earlier attempts, one reads that the final shipment described in the report, was of two cases of pineapples of the Smooth Cayenne variety, packed in fairly light wood boxes, with allowance for ample ventilation. Each fruit was wrapped in tissue paper, fine wood-wool being used as packing material. The fruits were picked on 31st October, when they were mainly green to dull greenish orange in colour and appeared to require five to six days to ripen. They had been placed base upwards in a cool ventilated place for two days, after which the stems had been dipped in molten paraffin wax. Packing had been completed by 3rd November and the cases had been placed in the ship's cool chamber on 5th November, the average temperature of which was 39°F throughout the voyage.

It is stated that the fruit arrived without trace of bruising. They were of good shape and size and attractive in appearance. The crowns were generally green and fresh and mould was practically absent from the surface of the fruit. The appearance, however, was rather dull and damp, due in part to the pines being rather ripe coupled with excessive juice content frequently found in this variety, and probably due also to the sweating which had taken place on removal from cold storage.

Trade opinion was generally favourable, size and shape were said to be satisfactory and the absence of any "frosted" appearance was noted. The slightly over-ripe, soft state of some of the fruits was mentioned, but it was considered this could easily be remedied by experience. Reference was also made to the rather dull, damp appearance, compared with the bright, dry Azores pines, but it is considered doubtful whether under existing conditions the colour and appearance could be appreciably improved

Reference is made to recent storage experiments with Queen Pines (the variety used for the canning industry in Malaya) at the Low Temperature Research Laboratory, Cape Town. It was shewn that great differences in keeping quality exist as between different strains of this variety and that keeping quality is often associated with the flat surface of the fruitlets. It was

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* Empire Marketing Board, Experimental Consignments, Report No. 7—"Report on Experimental Consignments of Zanzibar "Pineapples."

also shewn that the normal ripening processes in pineapples take place in storage only at temperatures of 43°F. or above. Below this temperature, abnormal changes take place, indications of breakdown occurring after three weeks storage below 40°F, and deterioration setting in rapidly on removal. On the other hand, at 40°-50°F, soft rot, caused by moulds and yeasts, rapidly develops. It would seem, therefore, that 40°-45°F represents the best storage temperature.

# REVIEWS.

## "The Termite-proof Construction of Buildings in Ceylon."

BY

F. P. JEPSON.

*Bulletin Agri. Ceylon, No. 85. 36 pp.*

*26 pls. 10 refs. Colombo, March, 1929.*

Termites are responsible for enormous damage to woodwork in buildings in Ceylon, but in spite of this, there appears to be no definite scheme of building construction whereby immunity from attack may be secured. Fifty species are recorded from Ceylon and of these seven are considered of importance.

The only measures to be adopted against subterranean termites is the construction of termite-proof buildings and the author gives several examples and diagrams of the method of construction.

For the treatment of nests in the ground the use of arsenic and sulphur or calcium cyanide is recommended.

Other species are able to form colonies in isolated woodwork; thus it is obvious that the problem of constructing termite proof buildings requires to be considered from two entirely different aspects.

With the species having the power to form colonies in isolated portions of dug woodwork, the adoption of timber which has been thoroughly impregnated with creosote or some similar substance is essential.

The selection of suitable timbers for impregnation is discussed and the appendices include lists of Ceylon timbers considered in relation to Termite attack.

The proposals laid down by the author are worthy of deep consideration, by architects and engineers, whose co-operation with entomologists should result in the formation of termite-proof schemes suited to any class of building sufficiently valuable to warrant the expenditure on protection.

N.C.E.M.

## Year-Book 1928.
## Department of Agriculture, Gold Coast.

***Bulletin No. 16. Issued by the Director of Agriculture. 1929.***

The Year-Book for 1928, of the Gold Coast Department of Agriculture is recently to hand: it is much larger in size than its two predecessors, and constitutes a bulky volume of some 300 pages. It contains some forty papers contributed by various members of the Gold Coast Department of Agriculture Staff and is a volume of considerable interest. It is a matter for argument whether the inevitable delay which such a system of publication involves to

certain papers may not be a considerable drawback, on the other hand, the advantage of having the year's output of a Department grouped together in one publication is in many respects incontestable.

As is to be expected, the papers deal mainly with the cacao industry, sixteen out of the forty papers being concerned with this crop. Other crops dealt with include rice, coconuts, oil palm, maize, cotton and cover crops. Of particular interest to Malaya is the paper by the Director of Agriculture on local cacao prices and the standardisation of quality; it is proposed to reproduce this paper in abstract in a later issue of the Malayan Agricultural Journal by reason of the relationship borne by the points therein discussed to the cognate problem in relation to rubber and other small producers' crops in this country.

Mr. Scott's paper on the sampling of copra is also of interest locally in view of efforts recently inaugurated to standardise this type of produce in Malaya. Attention may also be called to the account of the experiments carried out at Kumasi on a particular sequence of rotation of food crops. This represents an attempt to work out rotation for native agriculturists with a view to superseding shifting chena cultivation and is obviously a parallel of the similar work now being carried on by the Ceylon Department at Dambulla.

Mention may be made of the publication of the research programme of the Economic Botany Division. The publication of research programmes by the divisions of Tropical Agricultural Departments should be strongly encouraged, as it tends to prevent overlap and assists in co-ordinating the work of different Departments working on cognate problems.

The book is profusely illustrated and well presented; and the Gold Coast Department is to be congratulated on its production.

H.A.T.

# DEPARTMENTAL NOTES.

## The Agricultural Advisory Committee.

Under the Chairmanship of the Director of Agriculture, a meeting of the recently augmented Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 24th January, 1930.

The Committee as now constituted is representative of the various agricultural industries and commerce of Malaya, and in addition, of the Co-operative Societies Department, the Rubber Research Institute of Malaya and the Education Department.

The Committee dealt with a wide range of agricultural subjects, supported by reports and memoranda which were circulated to members before the meeting. The following notes indicate the range of the discussions.

*Tapping of Sugar Palm* (*Arenga Saccharifera*).—The Committee was supplied with a memorandum on the progress of the experiments conducted at Serdang. The Chairman drew attention to the more important points and especially to the enormous variation in the amount of juice collected from individual trees.

*Pineapples.*—The meeting was informed of the present position of the market for Malayan pineapples, the growth of the trade and the gradual improvements effected in the canning industry. Publicity, through exhibitions in the United Kingdom, was stimulating demand and it was proposed this year to push the sales of Malayan pines on Continental markets. The Chairman pointed out that the real issue is that of maintaining an established industry of some considerable size with an exportable value of £1,000,000 sterling, rather than considering projects of extension. A projected Pineapple Experimental Station at Singapore was discussed. The Station is designed to investigate the possibility of growing pineapples as a permanent crop. The need of economic investigations in addition to the usual scientific experimental work was considered by the meeting. The Chairman agreed to the principle but thought that the first step is to commence the experimental work.

*Fertilisers Enactment.*—The draft of an Enactment drawn up by a small Sub-Committee was discussed. Similar action is being taken in Ceylon, but the Malayan draft is based on the English Enactment. The machinery for enforcing the Enactment was considered. The Committee agreed that the provisions of the Fertilisers Enactment as drafted are likely to meet a definite want and recommended its transmission to Government.

*Research Programmes prepared by Heads of Divisions.*—Various points in connection with research programmes were raised, amongst which were the publication of results, the manufacture of coir matting, work on pepper and the charges made by the Department for soil analyses.

*Coconut Research.*—The desirability of extending the experimental area under the control of the Department was discussed. Size and site of the area, planting distances, possibility of co-operative work with Managers of various estates on small experimental areas in the different coconut districts in Malaya were among the items discussed under this head.

*Field Officers Reports.*—Monthly reports are submitted to the Committee and are considered at its meetings. Arising from one such report the question of policy of the Department was discussed, with regard to disease work on rubber, in view of the possibility that such work might overlap with the work of the Rubber Research Institute. The Chairman emphasised the vital importance of co-operation between the Department of Agriculture and the Rubber Research Institute with both European and the native planters of rubber, and was of opinion that any arrangement which makes for smoother working between the two Departments should be encouraged. This view was supported by the Director of the Rubber Research Institute.

Among other subjects dealt with at the meeting were financial estimates, mushroom culture, publications, padi distribution for seed purpose and coconuts in estate labourers' diets.

## Coconut and Oil Palm Research Committee.

At a meeting of this Departmental Committee, held on January 13th, 1930, the research work contemplated by the Department was reviewed in the light of progress already made in this country and elsewhere. Amongst other important matters upon which decisions as to policy were reached was for the establishment of two Meteorological Stations—one at the Coconut Experimental Station, Klang, and the other at the Rice Experimental Station, Titi Serong, Perak. At these stations, wet and dry bulb recordings will be taken four times daily, and evaporimeters will be installed, to enable a study of changes of moisture conditions and the corresponding changes in growing plants during the most important hours of the day.

Until positive scientific results have been obtained on the question of quality of copra, it was agreed that further consideration should be postponed on the somewhat controversial subject of marketing copra.

## Statistical Division.

The Governments of the Federated Malay States and Straits Settlements have approved the appointment of a Statistician in the Department of Agriculture. The value of agricultural statistics has not been overlooked in the past, but the work has been much hampered by lack of facilities for the collection of data.

Mr. J. Gordon-Carrie, B.Sc., Deputy Supervisor of Rubber, F.M.S., and Deputy Registrar-General of Statistics, S.S., who in the past has been entirely concerned with rubber statistics, is transferred to the Department of Agriculture

as from January 1st, 1930, and will compile not only the rubber statistics, but data concerning other crops in Malaya. The arrangement is for one year only in the first instance and will be subject to review at the end of that period.

## Leave.

Mr. F. S. Ward, Assistant Mycologist, has been granted seven months and twenty-nine days leave on full pay, with effect from the 10th January, 1930, inclusive.

Mr. W. N. C. Belgrave, Plant Physiologist, has been granted 11 days leave on full pay from 18th January 1930, inclusive, and two months and nineteen days leave on half-pay from 29th January, 1930, inclusive.

The leave of absence granted to Mr. B. Bunting, Agriculturist, has been extended for one month on half-pay with effect from the 22nd December, 1929, inclusive.

Mr. G. H. Corbett, Government Entomologist, returned from leave of absence on the 24th January, 1930.

Mr. L. A. J. Rijk, Librarian and Translator, returned from leave of absence on the 28th January, 1930.

# FROM THE DISTRICTS.

## The Weather.

January has been a moderately dry month on the whole but very heavy local afternoon showers fell in places, notably in and around Kuala Lumpur and in parts of Larut district and Bruas sub-district in Perak. Dry conditions continued in Pahang accompanied by strong breezes on the East Coast.

## Remarks on Crops.

*Rubber.*—Wintering had commenced in all districts at the close of the month and is reported to be proceeding very rapidly in Province Wellesley, where yields of latex have fallen off in consequence.

In West Pahang there has been an increasing tendency of late for Chinese small holders to plant catch crops among their young rubber. Bananas are fairly extensively used for this purpose, as are also ground-nuts and soya beans. The Agricultural Field Officer, Pahang West, now reports that ginger is also beginning to come into favour as a catch crop with rubber.

From the same source a report states that a Chinese cultivator in the district of Raub has recently budded his whole area of 400 acres. This may possibly have been an outcome of the bud-grafting demonstration given by the Rubber Research Institute at the Bentong Agri-Horticultural Show last September, although no definite information is to hand on this point.

In connection with the recent removal of the heavy import duty on alum, enquiries were instituted as to the extent to which this substance is now being used as a latex coagulant by small cultivators. Complete information is not yet to hand but sufficient reports have been received to indicate that alum has ceased almost entirely to be used as a coagulant for rubber latex.

The usual inspection and enforcement of control measures for Mouldy Rot disease were continued throughout the month in all areas where the disease exists. A newly infected area was found at Sitiawan in Perak. It has been decided to make a special effort to foster a system of regular preventive painting throughout all infected areas with the object of lessening the number of cases of recurrence of the disease and the consequent enforcement of control measures, which include cessation of tapping. This cessation of tapping, necessarily a part of successful control measures, often leads indirectly to spread of the disease, notwithstanding all precautions, through dismissed tappers with infected knives and clothes obtaining work elsewhere.

*Padi.*—Reports from Krian indicate that the crop through the greater part of the district may prove to be better than was anticipated, for it improved considerably in appearance during the month, water being ample and damage by the leaf-hopper having subsided. This does not include the late-planted

Gunong Semanggol—Selinsing—Brieh areas, which in late seasons always necessarily receive irrigation water later than the main portion of the land covered by the Krian irrigation scheme, and which consequently suffer badly in such seasons, of which the present one is an example. The prospects here, where irrigation facilities are defective, is very poor indeed, but are even worse in Province Wellesley, where no irrigation facilities exist and where the weather throughout the season has been exceptionally unsuitable for padi. In the earlier planted areas of Krian, flowering was general at the end of the month.

A good crop is expected in the Kuala Kangsar and Upper Perak districts and in the sub-district of Selama, in all of which areas the crop is at the flowering stage. In Larut district proper, prospects are not bright, owing to late planting from lack of water and subsequent unsuitable weather.

In Kinta and Batang Padang districts of Perak a fair crop was being reaped at the end of the month, but the crop in Lower Perak has again suffered somewhat severe damage from rats.

A good average crop is being harvested in Negri Sembilan, and in Malacca, where harvesting is also in full swing, yields obtained are reported to be very satisfactory.

In West Pahang, departmental pedigree strains, distributed to approved cultivators, have proved their worth, in some cases having given exceptionally heavy yields. Actual comparative figures are not yet available, but cultivators are so satisfied with results that arrangements have been made for extended distribution for next season.

No regular departmental reports are received from the important padi areas of Kedah and Kelantan, but information to hand indicate that the Kedah crop is unusually poor, owing to exceptionally dry weather throughout almost the whole of the padi season.

During last year an area on the Rompin river in Pahang was explored with the object of determining its possibilities as a padi area. Analyses of samples show that the soil is satisfactory and a recent comprehensive report by the Agricultural Field Officer, Pahang East, indicates that an area of approximately 8,000 acres is eminently suitable for padi cultivation. There would appear to be an adequate water supply to provide full irrigation for this area.

*Tea.*—To date, 5,700 acres have been alienated for the cultivation of tea on Cameron's Highlands and further applications are being received.

The Agricultural Field Officer, Perak South, reports that a good stand has been obtained by planting basket plants and stumps, of the thickness of a lead pencil, on an area where planting young seedlings and seed-at-stake had proved unsuccessful on account of dry conditions.

*Tuba Root and Chillies.*—Attention was directed last month to the possibilities of profit to the small cultivator by growing chillies. Some interesting figures are now to hand relating to the cultivation of tuba, with chillies as a

catch crop, in the district of Kinta. The tuba yielded 12 pikuls an acre after 18-24 months and the produce was sold locally, ungraded, for from $16 to $20 a pikul or from 32-40 cents a kati. The chillies yielded from 80 to 100 katis an acre after four months and were sold locally for from 24 to 30 cents a kati.

*Jelutong and Coffee.*—In the Temerloh district of Pahang an area of 940 acres has been alienated for the cultivation of jelutong. Up to the present, some 25 acres have been planted at 30′ x 60′ and coffee planted as a catch crop. The jelutong trees are said to be making good growth.

*Notes on Demonstration Stations and Padi Test Plots. Perak.*—The Poultry Station at Kuala Kangsar has made a good start, both fowls and ducks having laid well throughout the month. Two incubators, each of 100 eggs, were set with both fowl and duck eggs. As advertised elsewhere in this journal, a limited number of eggs is available for sale from time to time at $4/- a setting.

*Negri Sembilan.*—Twenty nine budded citrus were distributed during the month from Seremban Station.

The crop has been harvested at Jelebu Padi Test Plot but yields are not yet to hand.

*Pahang.*—At the Kuala Lipis station cowpeas and ground-nuts were harvested during the month and eight standard plots for tapioca trials were prepared. Plots were also laid down with various cover crops for demonstration purposes. Harvesting was completed at the Dong and Temerloh Padi Test Plots. Yields from the latter were somewhat disappointing: figures are not yet available regarding Dong plot.

The annual report on the Pekan Padi Test Plot is now to hand. Notwithstanding the dry season, some of the pedigree strains gave very satisfactory yields thus indicating their suitability to withstand dry conditions.

*Malacca.*—At Pulau Gadong Padi Station harvesting commenced with short season padi varieties on January 9th and is still in progress. Good yields are being obtained. A party of over 100 "Penghulus" and others visited the station on January 21st.

# MARKET PRICES.

## January, 1930.

*Rubber.*—The average London price of Rubber for January, 1930 was 7.3 pence per lb., being a fall of .6 pence over the corresponding figure for December, 1929. The highest price quoted was $7^{15}/_{16}$ d., while the lowest quotation was $6^{15}/_{16}$ d. The average Singapore price was 24.6 cents, against 26½ cents in December; the highest price being 26¾ cents and the lowest 23 cents.

*Copra.*—On December 28, Straits F.M.S., copra was quoted at £22-10-0 per ton C.I.F., compared with Ceylon F.M.S. at £23-15-0 per ton. In Singapore, copra varied from $9.35 to $9.45 S.D., and $8.95—$9.00 F.M. per picul.

*Palm Products.*—Prices easier: Hull on January 8th reports palm kernel oil at £31.10.0. Palm oil quotations, early in January were as follows:—Lagos 33/6, softs 32s., mediums 32s., hards 33/6, bleached 34/6, spot.

*Coffee.*—Supplies small, meeting a dull market moving in buyers' favour Fine grades remain steady. Kenya, bold common to fine general 99s-157s. Medium 83/6-110s. Costa Rica bold common to good general 97s.-128s.

*Tapioca.*—Med. Pearl 23/- to 24/- per cwt. E.I. Flake fair, spot 21/- per cwt.

Singapore, January 18th quoted Flake $5.35, Pearl Med. $8.

*Sago.*—Singapore prices lower: Pearl $7⅞, Flour $4.20/4.22½.

*Spices.*—Cloves. Penang 1/7-1/9. Zanzibar, 10¾d. Mace. Ord. to Gd. 3/3-3/10 per lb. Pepper. No material change, but forward prices firmer. Spot Singapore 11¾d. Singapore quotation $42/43.

*Clove Oil.*—(90/92%) 8s. per lb.

*Sisal Hemp.*—E. African, 33/10-35/10.

*Kapok.*—Java 11¼-11¾d; Calcutta 8-9½d.; Ceylon 10¾-11¼d.

*Gambier.*—Singapore quotations, January 18th, $9½/9 per picul, Cube No. 1 & 2. $15¼ per picul.

The above price list is intended to indicate the trend of prices during the latter half of December and the first half of January. With the exception of rubber for which the daily quotations for January have been examined, the information given has been drawn from the Singapore Chamber of Commerce Market Reports for January; "The British Trade Journal & Export World" for January; "Tropical Life" January; "The Chemist & Druggist," January 4th. "The Chemical Age," January 4th. and "Perfumery & Essential Oil Record," December 23rd.

Prices in Sterling are London quotations, while those in Straits Dollars ($1 = 2s. 4d.) are Singapore quotations.

*Erratum*: Vol: XVIII, No. 1 January 1930, page 59: for "Olive Oil" read "Clove Oil."

# RUBBER STATISTICS.

**Stocks of Rubber held by Dealers and on Estates of over 100 Acres on 31st December, 1929, together with the Declared Production of the same Estates and certain Export Figures.**

(Stocks Compiled from Returns by Estates and Dealers.)

| Territory. | Stocks. | | Estates declared production during the month. Estimated dry weight, all grades. | Total exported by estates and dealers during December. (*a*) |
|---|---|---|---|---|
| | Stocks held by dealers. | Estimated dry weight total stock held by estates. | | |
| | Tons. | Tons. | Tons. | Tons. |
| Federated Malay States ... | 11,538 | 16,222 | 14,613 | 22,419 |
| Johore ... | 2,343 | 5,616 | 4,234 | 8,280 |
| Kedah ... | 445 | 2,332 | 2,367 | 3,825 |
| Kelantan ... | (*b*) | (*b*) | (*b*) | 558 |
| Trengganu ... | (*b*) | (*b*) | (*b*) | 128 |
| Perlis ... | (*b*) | (*b*) | (*b*) | 27 |
| Straits Settlements, Malacca ... | 2,247 | 1,986 | 1,649 | 3,628* |
| ,, Province Wellesley ... | 161 | 867 | 687 | |
| ,, Dindings ... | 42 | 155 | 113 | |
| ,, Singapore Island ... | 27,949 | 379 | 293 | |
| ,, Penang Island ... | 5,208 | 15 | 15 | |

(*Estimated.)

NOTES.—(*a*) Exported means left the territory irrespective of destination.

(*b*) Figures not available.

(*c*) With effect from January it is intended to publish these Statistics in a new form which will give further details.

J. GORDON-CARRIE,

*Deputy Registrar-General (Statistics), S.S. & F.M.S.*

*Deputy Supervisor of Rubber (F.M.S.)*

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# Committees of the Department.

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**The Advisory Committee.**

The Director of Agriculture (Chairman).
The Director, Rubber Research Institute.
The Director of Co-operation.
Mr. O. T. Dussek, representing the Education Department.
Yang Teramat Mulia Raja Abdul Aziz, C.M.G., Raja Muda of Perak.
The Hon'ble Mr. Egmont Hake, M.F.C.
Mr. Choo Kia Peng, C.B.E.
Mr. J. Melville.
Mr. M. J. Kennaway.
Mr. L. P. Jorgensen.
Mr. W. A. Stanton.
Mr. G. S. Reis, B.Sc. (Agric.)
Mr. A. Sharples (Secretary).

**Agricultural Pests Supervising Committee.**

(Under Sec. 4 of Agricultural Pests Enactment 1913)
The Director of Agriculture (Chairman).
The Hon'ble the Legal Adviser.
Mr. F. H. Mustard.
B. J. Eaton, O.B.E.

**The Departmental Technical Committee.**

The Director of Agriculture (Chairman).
The Heads of Divisions.
Mr. F. S. Ward (Secretary).

**Coconut & Oil Palm Research Committee.**

The Director of Agriculture (Chairman).
The Mycologist
The Agriculturist.
The Economic Botanist.
The Plant Physiologist.
The Agricultural Economist.
The Agricultural Chemist.
The Entomologist.

THE

# Malayan Agricultural Journal

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## EDITORIAL.

**The Rice Situation.**

Circumstances are causing attention to be focussed more and more on the economic questions underlying agricultural production in the tropics. Probably at no single time has there been a concatenation of low prices in so many tropical products as at the present day. Rubber, copra, tea, coffee and sugar, to enumerate certain of them, are all suffering from depressed market conditions, and this depression is due in every case to the same cause, namely, disability to regulate the production of these staples in accordance with the demand. The world is really only commencing to realise the vast potential producing power of the tropics, and the measure to which it is capable of being increased by the systematic application of scientific knowledge to production.

Coupled with this increasing production is a rapidly increasing population, and to meet the needs of this population there must be an equally rapidly increasing food supply; this in turn directs attention to the rice situation, which, at any rate in the Eastern Tropics, is the key to the economic position.

In Malaya and Ceylon, the tendency is markedly to develop an export trade in other staples and to trust to importation of food stuffs to supply the needs of the population.

In Java, on the other hand, as also in the Philippines and Japan, the Governments have placed the development of a domestic food supply in the forefront of policy, and as a result, the rice supply has steadily augmented in these countries; notwithstanding this, the demands of the increasing population have, in Japan at least, caused that country to be converted of recent years, from an exporting into an importing unit.

The view officially held in these countries is well expressed in Copeland's well-known book on Rice in the following terms:—"The economic condition which results from the supplanting of rice by export crops of other kinds is decidedly unsafe. Let the market for the export crop fail, and the resulting condition is at once worse than the prevalent oriental poverty. Government in Java, Japan, and the Philippines has therefore done well in giving its keenest attention to stimulating the production of rice. The market may slump as it will, where rice itself is the export crop, without serious consequent suffering. But where other crops must furnish the money to buy foreign rice, hunger may enter promptly when rubber, tobacco, coffee and tea, and copra cannot be sold."

In a document presented to the recent Pacific Science Congress, Dr. M. B. Smits, Acting Chief of the Division of Agricultural Economics of the N.E.I., Department of Agriculture has reviewed the rice situation of the world. In this review he shows that for rice import the world is principally dependent on three countries, viz., British India including Burma, Siam and Indo China, of which, on the average, the production of British India is about equal to the other two, giving a gross potential production for all these of approximately 4,000,000 tons per annum. The quantity of rice available in these countries for export does not show a marked tendency to increase, and data do not warrant the expectation that any increase will occur. In the presence of such a condition of affairs and with low markets for other export products, a failure of the rice crop in these exporting countries may well create a condition of serious crisis throughout rice importing countries. Under such conditions, particular interest therefore centres at present in all matters relating to the domestic rice production of Malaya, and in this connection particular attention may be directed to an article appearing elsewhere in this issue in which the rice position in Malaya is reviewed.

**Colombian Pita Fibre.**

A prospectus has recently come to hand announcing the formation in London of a company to be known as Fibre Products (Pita) Limited, with the object of exploiting Pita fibre in the Republic of Colombia, South America.

It is generally known that the cultivation of the Colombian Pita plant (*Bromelia Magdalenae* Wright) was attempted in the Federated Malay States some seven years ago under the name of Arghan Fibre. The failure of the Arghan Company was due, as far as can be ascertained, to lack of suitable decorticating machinery and eventual exhaustion of the company's capital. A description of this fibre plant and its uses was published in the Malayan Agricultural Journal, Vol. XII (1924) page 185.

The present company proposes to acquire a large tract of land at Las Tangas in Colombia, containing indigenous Pita plants. From the prospectus it appears that the plants occur wild in considerable abundance. It is estimated that on one portion of the estate alone, comprising an area of 2,750 acres, a minimum yield of 1,500 tons of fibre per annum may be obtained at the present time without undue cutting. It is also proposed to extend the area under Pita by planting, so as to produce a further 1,500 tons of fibre per annum.

The fibre is stated to be suitable for use in the manufacture of fine strong twine and high-grade paper.

This appears to be the third attempt to exploit Pita fibre. The present company proposes to produce 300 tons of fibre during the first working year. A specially constructed decorticating machine is stated to be in use with satisfactory results.

Colombian Pita grows luxuriantly under suitable conditions in Malaya.

The results, therefore, of the new venture in South America will be watched with considerable interest here.

**School of Agriculture, Malaya.**

Under the above heading, this issue contains an article by Mr. G. E. Mann, Agricultural Instructor in the Department of Agriculture, giving some account of the projected organisation of the Malayan School of Agriculture which it is anticipated will be ready for opening in 1931. The article in question indicates the various steps which led to the inception of the proposals and also outlines the syllabus of instruction. Of recent years, increasing attention has become directed to the question of agricultural education, and it is now recognised universally that some such provision is necessary. In Malaya, hitherto the facilities for agricultural education have been strictly limited. The inauguration of the school will mark a decided step in advance, which should go some distance towards bringing Malaya into line with adjacent countries, e.g., Ceylon and Java, where progress in the same direction has been much more marked.

It should, however, be noted that agricultural education cannot be regarded as beginning or ending with the provision of one single institution for the instruction of students. The requirements of different sections of the community should be taken into consideration and the attempt made to obtain a picture of agricultural education as a whole rather than as a series of separate parts. Particularly is this the case in the relationships which obtain between elementary and more advanced agricultural education. A prominent and particularly satisfactory feature of education in Malaya is the marked agricultural bias which has of late years been given to elementary education in Malay Vernacular Schools, due primarily to the work of the Sultan Idris Training College at Tanjong Malim. Elementary rural science and school gardening is now taught in the majority of the Malay Vernacular Schools throughout the Peninsula and this should be regarded as the first step in a general system of agricultural education which will, it is hoped, ultimately arise, and which will comprise farm schools providing for the further instruction in agriculture of past pupils of elementary schools together with a central agricultural school, which provides for higher training in agriculture of pupils who have already attained the standard required in the higher classes of the English schools.

On the degree of knowledge of agriculture possessed by its inhabitants the future of an agricultural country in large part depends, hence these efforts towards establishing a system of agricultural education in Malaya based on experience obtained in many other countries, have considerable permanent interest.

# ORIGINAL ARTICLES.

## TEA EXPERIMENTS.

BY

J. N. MILSUM,
*Assistant Agriculturist.*

### Introductory.

A memorandum on the work conducted by the Department of Agriculture with the experimental cultivation of tea was prepared for a special meeting of the Advisory Committee held on the 28th November, 1928. This memorandum was published in the Malayan Agricultural Journal, Vol. XVII,. No. 1 (January, 1929). It is now proposed to record the work undertaken during the year 1929 at the Government Plantations at Serdang in Selangor, and Cameron's Highlands in Pahang.

### Experiments at the Government Plantation, Serdang.

The areas under tea at Serdang represent average conditions on the plains in Selangor, the soil consisting of a friable clay loam, with occasional outcrops of "laterite," derived from parent quartzitic rock.

### Mature Tea Area.

This area comprises one-acre plots of four varieties of Assam and Manipuri jats and a one-acre plot of the local Chinese variety. Of the former, Dangri seed was sown on the 16th December, 1924, and Dhonjan, Betjan and Rajghur seed was sown on the 18th January, 1925. All seed were germinated in boxes and the newly-germinated seedlings planted direct in the field at a distance of 4 feet by 4 feet, giving 2,722 plants per acre.

The plants were all pruned back to within about 9 inches from the ground in October, 1926. The bushes were again pruned in October, 1927, to within 3 inches of the previous cut. The tea plants were again heavily pruned during August, 1928. On the 12th October, 1928, a regular seven-day round of plucking was commenced and the yields of fresh leaf have been recorded since that date.

The following table records the actual weights of fresh leaf harvested during the first year of plucking. It should be noted that no comparisons may be made between the totals of the fresh leaf for the year owing to variations of the numbers of bushes in each plot. All vacancies have now been supplied, but it was not possible to do this previously owing to lack of seed of the particular jats.

**Assam Tea**, 5 years old, at the Government Plantation, Serdang.

## TABLE I.

*Monthly Yield of Tea Leaf from 12th October, 1928 to 11th October, 1929.*

| Month. | Dangri. | Dhonjan. | Rajghur. | Betjan. |
|---|---|---|---|---|
| | lbs. | lbs. | lbs. | lbs. |
| October (part) - | 117 | 85 | 28 | 40 |
| November - | 210 | 37 | 72 | 46 |
| December - | 182 | 236 | 195 | 154 |
| January - | 191 | 147 | 123 | 109 |
| February - | 190 | 147 | 130 | 84 |
| March - | 175 | 129 | 158 | 119 |
| April - | 113 | 121 | 59 | 43 |
| May - | 197 | 210 | 145 | 298 |
| June - | 288 | 248 | 241 | 208 |
| July - | 307 | 293 | 199 | 303 |
| August - | 188 | 165 | 148 | 161 |
| September - | 239 | 201 | 242 | 255 |
| October (part) - | 55 | 60 | 52 | 50 |
| Totals | 2,452 | 2,079 | 1,792 | 1,870 |

In the following table the actual yields of leaf and the calculated yields of made tea from the respective plots, on a basis of 1 lb. tea to 4 lbs. green leaf, are shown together with the number of bushes plucked in each plot.

It is to be noted that the calculated yields of tea shown in the last column are those from the actual bushes in cropping only. In the case of Betjan only half the possible number of bushes per acre were plucked.

Yields from the one-acre plot of Chinese tea are not recorded, as this area, being on the steepest part of the land, suffered considerably from soil erosion, which resulted in a large number of the bushes dying. This plot was supplied with seedlings during April of this year.

## TABLE II.

*Yields of Leaf and Calculated Yields of Tea from 12th October, 1928 to 11th October, 1929.*

| Jat. | No. of bushes plucked. | Percentage actual to possible bushes. | Actual Weight of leaf plucked. | Calculated yeild of tea per plot. |
|---|---|---|---|---|
| | | | lbs. | lbs. |
| Dangri - | 2,249 | .826 per cent. | 2,452 | 613 |
| Dhonjan - | 1,749 | .644 ,, | 2,079 | 520 |
| Rajghur - | 2,198 | .807 ,, | 1,792 | 448 |
| Betjan - | 1,313 | .497 ,, | 1,870 | 467 |

*Soil Conservation.*—The original silt pits, dug 4 ft. × 1 ft. × 1 ft. between alternate rows of the bushes, have proved to be unsatisfactory and were replaced by a system of deep contour silt pits during August, 1929. Provided these pits are periodically cleaned out, it is considered that adequate protection against soil erosion is now afforded.

*Shade.*—Young trees of *Albizzia moluccana* were planted throughout the area at a distance of 32 feet by 32 feet, square planting. These trees were planted during April and have made rapid growth. Additional trees of *Grevillea robusta* and *Gliricidia maculata* were established as wind breaks and green manures respectively during April and May.

*Cover Crop.*—Several cover crops have been tried and discarded in favour of *Indigofera endecaphylla* which is fairly satisfactory, though subject to the attacks of insect pests. Every effort is now being made to encourage the growth of this legume throughout the entire area.

### Immature Tea Areas.

The following jats of tea seed were received during the year 1929:—Dangri 4 maunds, Dhonjan ½ maund, Rajghur ½ maund, Betjan ½ maund (January); Kirrimittia 5 maunds, Bogantalawa 25 lbs., (March); Mahawella ¼ maund (August).

The last three consignments, namely those from Kirrimittia, Bogantalawa, and Mahawella, were obtained from Ceylon.

### Block 16 (Area 9.12 acres).

This block was previously under pineapples. Owing to the configuration of the land little damage has occurred from soil erosion, though naturally the

soil is not as fertile as virgin land. Prior to planting the tea seedlings, a system of deep contour silt pits was undertaken. This system has proved satisfactory and little soil wash occurs, though heavy rains were experienced during October and November.

*Planting*.—This area was planted with four months' old Dangri seedlings during the month of May, 1929. The following planting distances were undertaken:—4 ft. by 4 ft. 3 acres, 4 ft. by 3½ ft. 3 acres, 4 ft. by 3 ft. 3 acres.

Although dry weather set in shortly after planting, the seedlings have made good growth. A number of vacancies occurred and these were supplied during October. There is little doubt, however, that the most satisfactory results are to be obtained by planting during the months of October, November, and December, when the rainfall is heaviest and planting conditions may be considered ideal.

*Shade*.—Seedlings of *Albizzia moluccana* were planted throughout the block at a distance of 32 feet by 32 feet. *Grevillea robusta* has been established on the two exposed sides of the block as wind belts.

## Block 15 (Area 10½ acres.)

This area, which was formerly under fodder grasses, was cleaned up in September, 1929, in preparation for planting seedlings of Kirrimittia, Bogantalawa and Mahawella jats received from Ceylon.

The following planting programme was undertaken during November: Kirrimittia 8 acres, various planting distances from 4 ft. by 4 ft. to 3½ ft. by 3 ft., Bogantalawa ½ acre, Mahawella ¼ acre.

A variety of shade trees are being raised in the nursery and these, when of sufficient size, will be planted throughout the area.

The entire block being comparatively flat, no soil conservation has so far been undertaken but drains, where necessary, have been put in. It is considered, however, that some system of silt pits will be necessary and this matter is receiving attention.

## Machinery.

The following tea machinery has been installed at the Government Plantation, Serdang:—

1 "Little Giant" Tea Roller (capacity 60 lbs. withered leaf per charge).

1 Roll Breaker, 9 feet long.

1 Tea Cutter, fitted with 3/8 inch cells.

In addition to the above, a set of hand sieves is employed for grading the fired leaf.

A temporary withering room has been constructed with about 1,000 square feet of "tats" available for withering the crop of green leaf. This accommo-

dation is insufficient for the present requirements and a proportion of the leaf harvested has to be withered on cement floors.

A "chula" drier is used for firing the rolled leaf with only partially satisfactory results.

Provision has been approved by Government in the 1930 Estimates for the erection of an experimental tea factory and purchase of necessary machinery to supplement that already in use.

Reports on tea samples grown and prepared at the Government Plantation, Serdang:—

A sample of tea produced from the 4 year—old bushes at Serdang, was submitted to Messrs. Keell & Waldock, Colombo, who forwarded the following report and valuation, dated 18th April, 1929, on the sample in question.

| Grade. | Colombo Value Rs. | London Equivalent Rs. | Remarks. |
|---|---|---|---|
| B. O. Pekoe | 1/05-1/10 | Nom. | Black, well-twisted, rather bold, irregular leaf, good appearance, fair show of bright golden tip. |

Liquor—Fair strength and colour, rather plain, common.
Infused leaf not bright enough, too mixed and irregular.
Liquor is dull and coarse and has been fired at too high a temperature.
The valuation is a nominal one on account of the good show of tip and appearance of the leaf. Without the tip the tea would be worth about -/62 cents.

A further sample forwarded to the Malayan Information Agency, London, was submitted to Messrs. Gow, Wilson & Stanton Ltd., who furnished the following report:—

"*Dry Leaf.* Blackish brownish, rather uneven broken, containing a good lot of small tea with just a few tips.

*Firing.* The tea has been heavily overfired.

*Liquor.* Whilst possessing some colour, tastes coarse and "bakey".

*Infused Leaf.* Dark and mixed, showing overfiring.

With reference to your letters of the 3rd and 5th April:

(1) Dry leaf is fairly satisfactory in appearance, but we should like to see it free from the small tea running through it.

(2) Presumably the tea has been hand-rolled and under these circumstances it is fairly satisfactory.

(3) The tea has been heavily overfired, bringing about a coarse and "bakey" character on the liquor.

Seeing that this tea has been produced at an elevation of 200 feet we are of opinion that when manufacture is carried out under proper conditions, it would compare very favourably with Sumatra and Java growths."

It will be seen from these reports that the samples were over-fired and with the present "chula" drier it is a matter of considerable difficulty to remedy this defect. It is anticipated, however, that with the addition of more suitable means of manufacture and the use of a proper drying machine in particular, it will be possible to produce tea of considerably better quality in the near future.

## Experiments at the Government Plantation, Cameron's Highlands, Pahang.

The Government Plantation at Tanah Rata is situated at the extreme south-east corner of the Highlands area, at an elevation of about 4,750 feet.

### Mature Tea Area.

This consists of a small number of bushes, raised from seed during January, 1925, of the following jats:—Betjan, Dhonjan, and Rajghur. The plants are spaced 4 feet by 4 feet apart and have made very vigorous growth. Plucking commenced on the 24th July, 1927, i.e., about $2\frac{1}{2}$ years from sowing the seed. The bushes have been cropped regularly at intervals of 9 to 10 days.

The following are the calculated yields of dry tea per acre from this area, taking the size of these plots as 1/6th of an acre:—

First plucking year ending 23rd July, 1928—470 lbs. per acre.

Second plucking year ending 23rd July, 1929—525 lbs. per acre.

Owing to the present inaccessibility of the Plantation, it has not been possible to instal any machinery. Further, the "chula" drier employed is of very primitive construction resulting in frequent occurrences of over-firing of the leaf.

Report on a sample of tea grown and prepared at the Government Plantation, Cameron's Highlands:—

Samples of tea obtained from 4 years-old bushes growing at Tanah Rata and manufactured by hand on the Highlands were handed to Messrs. Guthrie & Co., Ltd. Kuala Lumpur, who forwarded them to their London Office for report and valuation.

The following reports were received from (1) Messrs Chas. Hope & Son, and (2) Messrs Lloyd, Matheson & Carritt, dated 5th October, 1929:—

(1) "*Leaf.*—This tea has the appearance of a leaf well-graded Bro-Or-Pekoe with a fair show of good coloured tip and does not contain any very coarse leaf.

*Cup Quality.*—The liquor has the character which is usually associated with very young leaf. It is light in colour of cup and has indications of being somewhat overfired.

*Infusion.*—This is bright and is the best characteristic of the tea and rather leads us to suppose that the tea is well manufactured with the exception of being over-fired, but that the green leaf is lacking in essential oil.

The tea would sell on this Market in competition with low-grown Northern Indian Tea or Java, mostly for its appearance, its cup quality being unattractive.

To-day's value, the Market being on a very low basis, is about 11d."

| (2) Description. | Character. | Value per lb. |
|---|---|---|
| Hand Made Bro-Or-Pekoe | | 1/3d. |
| Leaf | Black, even, well made, fair tip. | |
| Infused Leaf | Fairly bright. | |
| Liquor | Light, brisk. little high fired. | |

**Immature Tea Area.**

This area consists of rising ground on Spur C at Tanah Rata. The land is mainly divided into 1-acre plots and was recently planted with the various jats as shown in the following table.

TABLE V.

*Planting Arrangement on Spur C at Government Plantation, Tanah Rata, Cameron's Highlands, Pahang:—*

| Plot No. | Area in Acres. | Jat. | Date from Seed. |
|---|---|---|---|
| 41 | ½ | Dangri | January, 1928 |
| 42 | ½ | Charali | March, 1927 |
| 43 | ½ | ,, Assam | March, 1927 |
| 44 | 1 | Amulguri | March, 1927 |
| 45 | 1 | Muttapong | January, 1927 |
| 46 | ¾ | Betjan | March, 1927 |
| 47 | ¾ | Dangri | January, 1928 |

| Plot No. | Area in Acres. | Jat. | Date from Seed. |
|---|---|---|---|
| 48 | 1 | Betjan | January, 1928 |
| 49 | 1 | Charali Manipuri | March, 1927 |
| 50 | 1 | ,, Assam | March, 1927 |
| 51 | ½ | Daugri | January, 1928 |
| 52 | 1 | ,, | January, 1928 |
| 53 | 1 | ,, | January, 1928 |
| 54 | 1 | ,, | January, 1928 |
| 55 | 1 | ,, | January, 1928 |
| 56 | 1 | Dhonjan | January, 1928 |
| 57 | 1 | Rajghur | January, 1928 |
| 58 | ½ | ,, | January, 1928 |
| 59 | ¾ | Dhonjan | January, 1928 |
| 60 | 1 | Rajghur | January, 1928 |
| 61 | ½ | Betjan | January, 1928 |
| 62 | 1 | ,, | January, 1928 |
| 63 | 1 | Rajghur | January, 1928 |
| 64 | 1 | ,, (2nd generation) | October, 1929 |
| 65 | 1 | Dhonjan | January, 1928 |
| 66 | 1 | Charali | January, 1928 |
| 67 | 1 | Rajghur | January, 1928 |
| 68 | 1 | Betjan | January, 1928 |
| 69 | 1 | Charali | January, 1928 |
| 70 | ¾ | ,, | January, 1928 |
| 71 | 1 | ,, Assam | January, 1928 |
| 72 | ¼ | Betjan | January, 1928 |

The bushes in this area are all quite young, but are making excellent growth. Certain areas planted early in 1927 are so advanced as to be almost ready for plucking.

Seed of Manipuri tea Rajghur, sufficient to plant one acre, was recently obtained from tea seed bearers at Ginting Simpah (2,000 feet elevation) in Pahang. This seed was planted at stake in Plot 64 in October.

Also 3,000 tea seeds have been obtained from Escot Estate, Tanjong Malim, from seed bearers raised from seed originally imported from an up-country estate in Ceylon.

*Soil Conservation.*—Various systems of soil conservation are being undertaken including terracing, terracing with silt pits, and contour silt pits.

Cover plants have been established on certain of the plots, the most promising of these at present being *Dolichos Hosei* and *Indigofera endecaphylla*, although the former is troublesome owing to its climbing habit.

*Shade Trees and Green Manures.*—The following trees are being tried as shade trees and wind breaks:—*Acacia decurrens*, *Albizzia moluccana*, *Dalbergia assamica* and *Grevillea robusta*.

*Erythrina lithosperma* (thornless dadap), *Gliricidia maculata* and "Boga medeloa" *Tephrosia candida* are planted as green manures.

The writer is indebted to Mr. T. D. Marsh, Senior Assistant Agriculturist, Serdang, and Mr. J. P. K. Wilkins, Superintendent, Government Plantation, Cameron's Highlands, for the crop records published in this article.

# REVIEW OF THE PRESENT POSITION OF RICE PRODUCTION IN MALAYA.

BY

W. N. SANDS,

*Acting Economic Botanist.*

In May 1929, the Economic Botanist (Dr. H. W. Jack) read a paper before the Pan-Pacific Science Congress held in Java entitled "The Present Position in Regard to Rice Production in Malaya". In the following article the more important portions of that paper are given together with additional notes and certain statistical tables which have been revised in order to include later information.

Rice production and supplies have always ranked as a problem of first importance with the Government because the rice situation dominates all other industries and is necessary to the progress of the country.

Malaya is essentially a rice importing country since over sixty per cent. of the rice consumed has to be imported and as long as such supplies are readily available, abnormalities in local production have little effect, except in Pahang and in the Unfederated Malay States situated along the East Coast of the Peninsula. Nevertheless, local production is of material importance since food crises must be regarded as periodic and liable to arise at comparatively short notice.

Moreover, during the past twenty years, the imports of rice into Malaya have increased enormously, chiefly on account of the increasing prosperity of the country following the introduction and rapid development of the rubber industry and the growth of tin mining. These two industries have combined to attract labourers from neighbouring countries in great numbers so that they now comprise approximately half of the entire population. These labourers have no facilities for producing rice—their staple food—and it is mainly in order to feed these immigrant labourers that the imports of rice have increased so extensively and must be maintained.

The Malay population has grown rapidly during the same period and an appreciable percentage of it has been drawn away from rice planting by the more remunerative attraction of rubber cultivation; nevertheless, except in a few districts, the Malays have steadily maintained their production of padi, the total acreage planted last season in the Peninsula being 687,000 acres.

It should be mentioned that the bulk of the Malay padi cultivators dwell in the Unfederated States where rubber cultivation is still in its infancy and where wage earning facilities are comparatively scarce so that they have to grow rice of necessity or do without it. In these territories the area planted for the 1929 crop was 436,000 acres, which represents 63% of the total for Malaya.

Imports of rice, as already mentioned, are related to a considerable extent to the condition of the rubber and tin industries. If these enterprises are flourishing then there is a large influx of coolies with a corresponding increase in imports and consumption.

Table I shows the local production together with imports and values of rice since 1918. It also gives the percentage of rice produced to that imported. The total consumption figures are based on the totals of production plus imports.

In converting padi into terms of rice, 700 gantangs of padi have been taken to yield one ton of clean rice, whilst 300 gantangs (Imperial gallons) of rice are calculated as equal to one ton.

TABLE I.

**Rice Production and Imports, Malaya.**

| Year. | Production, tons Rice. | Nett Imports, tons Rice. | Consumption, tons. | % Production to Imports. | % Production to consumption. | Value of Nett imports. $ |
|---|---|---|---|---|---|---|
| 1917-1918 | 178,482 | 344,000 | 522,482 | 52 | 34 | 33,157,000 |
| 1919 | 178,875 | 370,000 | 548,875 | 48 | 33 | 63,642,000 |
| 1920 | 153,690 | 336,000 | 489,690 | 46 | 31 | 101,517,000 |
| 1921 | 254,538 | 234,000 | 488,538 | 109 | 52 | 13,911,000 |
| 1922 | 201,038 | 364,000 | 565,038 | 55 | 36 | 25,500,000 |
| 1923 | 223,444 | 361,656 | 585,100 | 62 | 38 | 39,618,106 |
| 1924 | 213,074 | 394,282 | 607,356 | 54 | 35 | 48,893,492 |
| 1925 | 227,336 | 403,058 | 630,394 | 56 | 36 | 49,437,212 |
| 1926 | 171,449 | 474,847 | 646,296 | 36 | 26 | 61,765,380 |
| 1927 | 183,391 | 545,718 | 729,109 | 34 | 25 | 68,363,213 |
| 1928 | 193,038 | 523,770 | 716,808 | 37 | 27 | 62,692,772 |
| 1929 | 180,328 | 555,539 | 735,867 | 32 | 25 | 57,911,429 |
| Average | 197,000 | 409,000 | 606,000 | 48 | 32½ | |

The more interesting facts brought out in the above table are:—

(a) Local production, after due allowance for bad seasons, has been fairly well maintained.
(b) Production is only about one-fourth of consumption.
(c) Consumption has greatly increased during the past 10 years.
(d) Imports now average about 525,000 tons per annum.
(e) The average value of the imports for the last four years is 62½ million dollars (£7,353,000).

There has been a large and steady increase in population in Malaya during the last decade, the total population being now estimated at about 4 millions. If, as is usually estimated, 1 lb. of rice per head per day is required, the consumption figure would be 652,000 tons per annum as against the total shown in the table of 736,000 tons, so that allowance must be made for losses in storage and distribution, carry over stocks, possible errors in import and production weights and in other ways.

### Straits Settlements.

Table II shows the production of rice in the Straits Settlements. The trend of production is downward until cultivators began to feel the effects of the rubber slump in 1920 and thereafter crops were large until 1925 when rubber became profitable again. The sudden revival of rubber during 1925 caused a decrease in production in 1926, but the quick fall in rubber in 1926 was again followed by increased rice production in 1927, 1928 and 1929.

Rice imports into the Straits Settlements for consumption are about 180,000 tons annually.

TABLE II.

**Production in Gantangs of Padi. Straits Settlements.**

| Year. | Malacca. | Province Wellesley | Penang and Dindings. | Totals. | Totals. Tons of Clean Rice. |
|---|---|---|---|---|---|
| 1918 | 8,111,600 | 6,734,500 | 2,031,000 | 16,877,100 | 24,110 |
| 1919 | 6,873,400 | 7,325,000 | 1,580,125 | 15,778,525 | 22,541 |
| 1920 | 6,764,250 | 7,573,969 | 2,316,350 | 16,654,569 | 23,792 |
| 1921 | 7,887,700 | 10,150,000 | 4,028,850 | 22,066,550 | 31,524 |
| 1922 | 8,486,024 | 10,291,000 | 2,668,300 | 21,445,324 | 30,636 |
| 1923 | 8,525,582 | 14,350,000 | 2,110,515 | 24,986,097 | 35,694 |
| 1924 | 9,945,954 | 13,400,000 | 2,056,060 | 25,402,014 | 36,289 |
| 1925 | 0,795,332 | 9,553,500 | 2,390.500 | 22,739,332 | 32,485 |
| 1926 | 18,172,900 | 7,478,000 | 1,098,500 | 16,749,400 | 23,928 |
| 1927 | 8,303,706 | 8,600,000 | 2,426,750 | 19,330,456 | 27,615 |
| 1928 | 8,913,849 | 10,942,000 | 2,478,200 | 22,334,049 | 31,906 |
| 1929 | 9,588,337 | 11,624,200 | 2,179,080 | 23,391,617 | 33,417 |
| Averages. | 8,530,720 | 9,835,181 | 2,280,353 | 20,6416,253 | 29,949 |

No rice is produced in Singapore. The ratio of production to imports in Malacca is approximately 4 : 5 whilst in Penang and Province Wellesley (and including the Dindings) the ratio is roughly 1 : 2.

In Penang alone, only a very small percentage of the population is engaged in padi cultivation.

In Province Wellesley, there is a fair production of rice amounting roughly to 14,000 tons per annum and the ratio of production to imports in this area is about 2 : 3.

## Federated Malay States.

Table III shows that the production of rice in the Federated Malay States has not varied greatly except in the 1924—25 season when the slump in rubber left Malay cultivators with little cash to purchase rice, so that the rice fields were cultivated more extensively than usual.

The reduced production in 1919 was the direct result of the influenza epidemic during 1918—19 season, while the large drop in 1927 was due to the severe floods during 1926—27 season, when many acres of padi in Perak and Pahang were entirely destroyed.

Most of the immigrant labour in Malaya is employed in the Federated Malay States and consequently the imports of rice varied with the variation in rubber and tin prices, except during the abnormal years of shortage of supplies.

TABLE III.

**Rice Production and Imports, Federated Malay States.**

| Year. | Production tons of clean rice. | Import in tons of clean rice. | % Production to Import. | % Production to Consumption. |
|---|---|---|---|---|
| 1918 | 42,959 | 127,823 | 34 | 25 |
| 1919 | 38,298 | 164,059 | 23 | 19 |
| 1920 | 49,308 | 129,117 | 38 | 27 |
| 1921 | 49,350 | 107,176 | 46 | 32 |
| 1922 | 53,890 | 117,058 | 46 | 32 |
| 1923 | 54,245 | 127,747 | 42 | 30 |
| 1924 | 53,093 | 137,323 | 39 | 28 |
| 1925 | 66,069 | 157,458 | 42 | 30 |
| 1926 | 46,983 | 185,903 | 25 | 20 |
| 1927 | 31,663 | 182,778 | 17 | 15 |
| 1928 | 44,348 | 180,000 | 25 | 20 |
| 1929 | 45,137 | 180,000 | 25 | 20 |
| Averages | 47,945 | 149,704 | 34 | 25 |

## Unfederated Malay States.

Whereas the average annual production of rice in the Federated Malay States is only 48,000 tons, that of the Unfederated Malay States is 120,000 tons. In these States, the population is almost entirely Malay and the rubber and tin industries do not enter so prominently into the economic life of the population as elsewhere in the Peninsula.

TABLE. IV.

**Production in 1000 gantangs of Padi, Unfederated Malay States.**

| Year. | Perlis. | Kedah. | Kelantan. | Treng-ganu. | Johore. | Total. | Tons of clean rice. |
|---|---|---|---|---|---|---|---|
| 1918 | 5,324 | 38,315 | 30,000 | 3,000 | 1,350 | 77,989 | 111,413 |
| 1919 | 5,000 | 43,227 | 30·000 | 3,000 | 1,400 | 82,627 | 118,039 |
| 1920 | 4.077 | 27,186 | 21,000 | 2.500 | 1,650 | 56,413 | 80,590 |
| 1921 | 5,792 | 69,280 | 42,596 | 3,000 | 897 | 121,565 | 173,664 |
| 1922 | 5,847 | 37,302 | 33,924 | 3,000 | 1,485 | 81,559 | 116,513 |
| 1923 | 7,362 | 48,452 | 33,799 | 3,000 | 840 | 93,453 | 133,504 |
| 1924 | 8,076 | 40,809 | 34,040 | 3,000 | 660 | 86,584 | 123,691 |
| 1925 | 6,737 | 50,733 | 28,527 | 3,000 | 1,150 | 90,147 | 128,781 |
| 1926 | 9,048 | 32,780 | 25,025 | 3,000 | 511 | 70,363 | 100,519 |
| 1927 | 9,014 | 56,274 | 18,751 | 2,500 | 341 | 86,879 | 124,113 |
| 1928 | 5,434 | 53,236 | 18,834 | 3,000 | 1,245 | 81,749 | 116,784 |
| 1929 | 5,859 | 45,306 | 14,996 | 3,000 | 2,088 | 71,241 | 101,773 |
| Averages | 6,464 | 45,242 | 27,624 | 2,917 | 1,135 | 83,381 | 119,115 |

Normally, the States of Perlis and Kedah are self-supporting and usually export padi to the mills of Penang and Perak. Until a few years ago Kelantan, too, was self-supporting, but poor crops together with the increase of rubber cultivation in that State with its attendant influx of immigrant coolies and the

opening up of the country by railway development have necessitated annually increasing imports of rice during the past decade.

Trengganu and Johore have been large importers of padi for many years, since in Trengganu the bulk of the population live along the sea coast and are mainly engaged in the fishing industry, and in Johore, rubber, coconuts and other products have proved more lucrative to the Malay population than padi cultivation.

With the exception of Johore, the production of rice in the Unfederated States is, as yet, little affected by the competition of rubber, though in Kedah, thousands of acres are already producing rubber.

Thus, the total production of rice in the Unfederated States shows little variation from year to year, though bumper crops were reaped in 1921 in Kedah and Kelantan. In Kelantan, the influenza epidemic in 1918-19 was responsible for the very small crop in the 1919-20 season and severe floods had a similar effect in 1927, whilst drought was the disturbing factor in 1928. Exceptionally bad weather conditions in Kedah in 1920 resulted in a poor crop that year. High rubber prices and poor weather conditions were the cause of the small crop in Kedah in 1926.

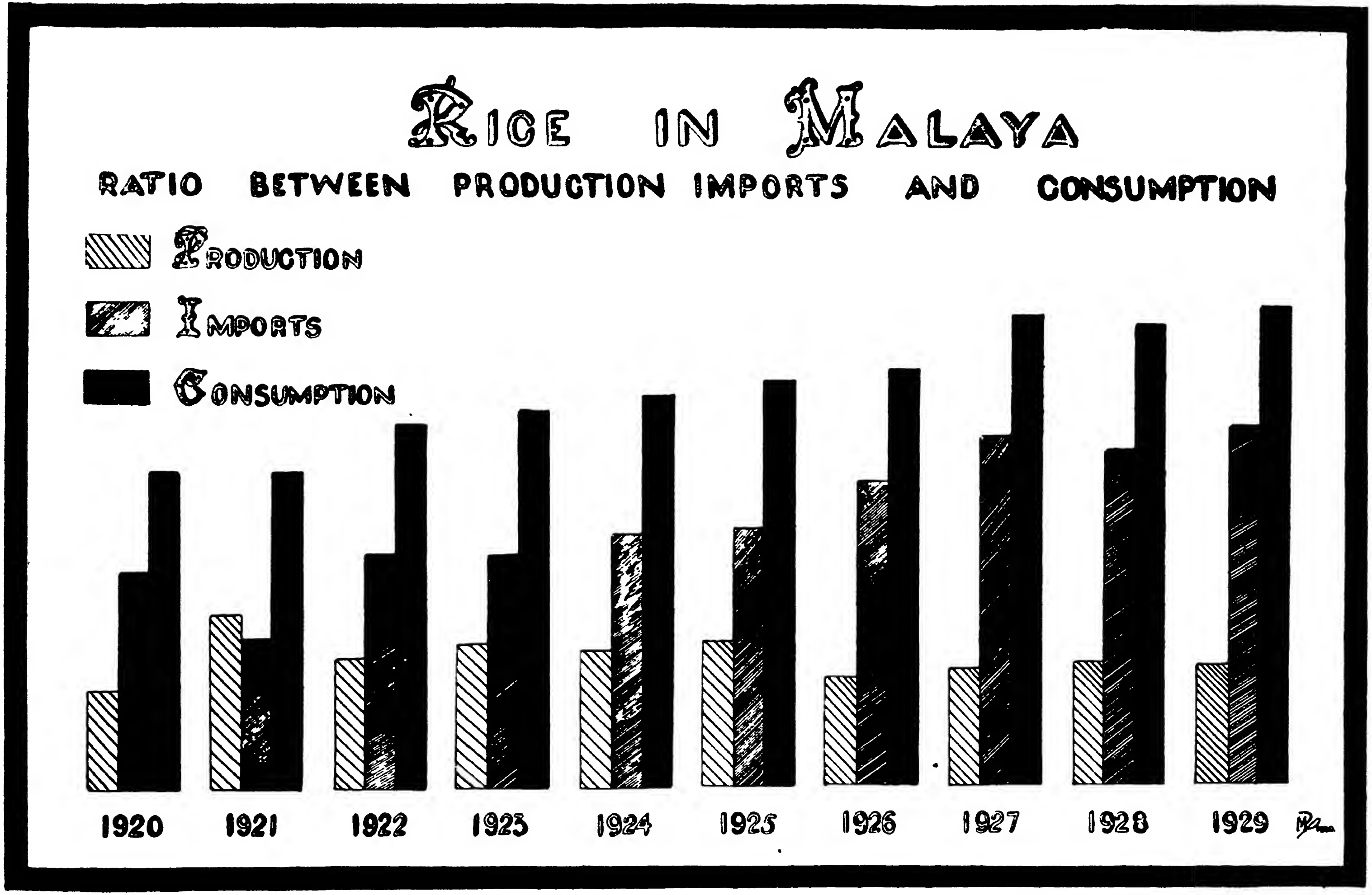
Figures of imports of rice into the Unfederated States on the East Coast are not very reliable for though almost all of the rice is shipped from Singapore it is said that fishing folk also import quite a lot from the smaller passing trading ships of which no record is taken.

The annual production of rice in Kelantan is roughly 12,000,000 gantangs of rice and the recorded imports now amount to some 4,000,000 gantangs in a normal year, though this amount is probably exceeded for the reason given above and is certainly exceeded in poor crop years. The ratio therefore between production and imports is in the neighbourhood of 3 : 1 though this ratio is by no means stable since rubber cultivation and other crops are gaining in competition with padi, so that rice imports are likely to increase.

In Trengganu, production averages 1,250,000 gantangs of rice or enough to feed about 30,000 of the population of 165,000; consequently, nearly 6,000,000 gantangs have to be imported annually; therefore the ratio of production to imports is approximately 1 : 5.

In Johore, the low production of some 420,000 gantangs of rice is only capable of feeding some 9,000 people while 310,000 must be fed from imported supplies; thus the ratio of production to imports is about 1 : 34.

Johore has a large area under rubber on which immigrant coolies are employed almost exclusively. The Malays also maintain important rubber, coconut, arecanut and fishing industries, so that only a very small percentage of the population has the facilities for rice cultivation—hence the extremely low production.


RICE IN MALAYA
RATIO BETWEEN PRODUCTION IMPORTS AND CONSUMPTION
PRODUCTION
IMPORTS
CONSUMPTION
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929

As already mentioned, Perlis and Kedah are self-supporting, though the rapid increase in the area under rubber in Kedah is likely in time to affect its present fortunate situation as regards food production.

The average ratios between the production of rice in the different States of Malaya and the imports are depicted graphically on the opposite page and need no comment.

As shown, Malaya imports two-thirds of its local rice consumption, so that should imported supplies be curtailed in any way, the seriousness of the food problem would immediately become apparent.

It is not long since the country suffered from a shortage of supplies and as a similar shortage is always possible again, methods must be devised to meet any possible crisis which may arise.

## TABLE V.

### Summary of Production of Padi in Malaya.

In Gantangs (one gantang = one Imperial Gallon).

| Season. | Federated Malay States. | Straits Settlement. | Unfederated Malay States. | Malaya. | Tons of Rice.* |
|---|---|---|---|---|---|
| 1917-18 | 30,071,214 | 16,877,100 | 77,989,000 | 124,937,314 | 178,482 |
| 1918-19 | 26,808,837 | 15,778,525 | 82,627,000 | 125,212,362 | 178,875 |
| 1919-20 | 34,515,636 | 16,654,569 | 56,412,510 | 107,582,715 | 153,690 |
| 1920-21 | 34,544,837 | 22,066,550 | 121,565,448 | 178,176,835 | 254,538 |
| 1921-22 | 37,723,059 | 21,445,324 | 81,558,533 | 140,726,916 | 201,038 |
| 1922-23 | 37,971,530 | 24,986,097 | 93,453,323 | 156,410,950 | 223,444 |
| 1923-24 | 37,165,363 | 25,402,014 | 86,584,295 | 149,151,672 | 213,074 |
| 1924-25 | 46,248,330 | 22,739,332 | 90,147,276 | 159,134,938 | 227,336 |
| 1925-26 | 32,888,134 | 16,749,400 | 70,363,217 | 120,000,751 | 171,429 |
| 1926-27 | 22,164,045 | 19,330,456 | 86,879,344 | 128,373,845 | 183,391 |
| 1927-28 | 31,043,556 | 22,334,049 | 81,749,436 | 135,127,041 | 193,039 |
| 1928-29 | 31,596,196 | 23,391,617 | 71,241,497 | 126,229,310 | 180,328 |

* Calculated on the basis of 700 gantangs of Padi to one ton of clean rice.

The problem of increasing and encouraging production is one that concerns the whole of Malaya, and the extremely unsatisfactory position which is shown to exist calls for an early enquiry into the possibility of enlarging considerably the output. There are already large padi areas in the Peninsula possessing a settled agricultural population, which have received little consideration from this standpoint. Take for example, the Unfederated States of Kedah, Perlis, Kelantan and Trengganu, where about 436,000 acres are annually planted and produce 120,000 tons of rice. In these places there are great possibilities; still irrigation problems have hardly been touched, and crops are good or bad according to whether the rainfall is ample or deficient. Again, scientific help and advice with reference to seed-selection, manuring, cultivation and control of pests is either not available or only so to a very limited and quite inadequate extent.

Production is already stimulated in most States by the remission or reduction of rent or premium on land suitable for rice; by assisting in the upkeep of irrigation works and water channels; distribution of selected seed and in other ways.

The investigation of new areas likely to be suitable for rice growing if irrigated, drained and settled, is another line of action which is being pursued; but this work, although most important, is necessarily slow and a much longer time is required to obtain results than by the improvement of existing areas.

# THE MANUFACTURE OF BANANA FLOUR.

BY

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*Assistant Mycologist.*

The manufacture of Banana Flour in Malaya was first exploited as a commercial proposition by a Singapore firm in 1924. It appears that the industry offered considerable possibilities but the chief difficulty was to obtain an adequate supply of fruit and to avoid an unfair rise in prices.

The following is an extract from the "Straits Times," dated August 6th, 1924, which refers to the manufacture of Banana Flour as one of the new Malayan industries.

> "In a shed equipped with the necessary machinery, a number of manufactures are being carried on, not the least interesting of which is production of flour from locally grown bananas for export to Europe. In fact, there are orders in hand for this flour from Europe, and it is hoped to meet the demand with the necessary machinery. At present, the standard of the quality of the flour turned out is up to the required standard, but the quantity obtained is not satisfactory; it is only a matter of time, however, before an improvement in the quantity obtained will be effected. Banana Flour is used at the present time in Europe as a raw material for bakeries etc. in the manufacture of chocolate, biscuits, cakes and also as a beverage mixed with Cocoa and Milk."

After experimenting with different kinds of bananas, it was found that the plantain, Pisang Tandok, gave the best results. The true banana, in any of the varieties tried out, did not give satisfactory flour, or could not be made into flour at all. There are two kinds of Pisang Tandok, one nearly white with a green skin and one red. Both are used in the preparation of the flour, which consequently has a yellow colour. Flour from the white variety is almost white, but it is possible that the full colour might lead to the idea that the flour is adulterated with some form of starch and consequently a preference for the preparation of flour with a distinctive colour is created. It is probable that Pisang Embun is the second most satisfactory variety for the manufacture of banana flour, although in the event of this variety being seriously affected by Panama Disease, there seems no reason why other varieties, so far found to be immune to this disease in Malaya, such as Pisang Serendah, Pisang Mundan, Pisang Masak Hijau etc. should not give satisfactory results.

In 1924, the supply of fruit was being obtained from Batu Pahat in Johore. The first price asked by the growers was $9 per thousand. For the second consignment the cost was $10 per thousand and another consignment cost $13

per thousand. The fruit was brought to the factory in a motor lorry, the journey costing $30; including duty in Johore, handling and transporting, the last consignment of fruit cost 1.81 cents each. This figure was rather high but could not be reduced until more experience was gained and other sources of fruit supply could be found. Now that there is an increased acreage of bananas under cultivation there is no doubt that this figure could be considerably reduced.

At the time when banana flour was being manufactured at Siglap the growers would not allow any selection of the fruit for size. Large and small had to be taken together in each lot of 1,000. For transportation purposes the "hands" were cut off the bunch and the individual fruits were left attached to the stalks of the hand in order to prevent them from ripening too quickly in the factory.

### Procedure in the Manufacture of Banana Flour as carried out Locally.

In Singapore, the flour was manufactured by a "Sirdar" Flour Mill, provided by E. R. and F. Tinner Ltd. of Ipswich, England, mainly for use in India. The price was about $250 and was capable of producing two tons of flour a day. The mill was driven by a motor of 4 H.P. on the break; this was capable of driving slicing machines as well.

Near a table for peeling the fruit by hand is a treadle sewing machine fitted with a knife for slicing the fruits. The fruits are cut transversely, about one twelfth of an inch thick. Slicing costs about one cent per pound of flour for labour.

Two hot-air dryers were used which were made on a German pattern. One was purchased in Germany for $200, and the other was a copy of the first and was made locally for $60, the dryer apparently not being protected by patent in Singapore. Each dryer is about two and a half feet square in cross section and about ten feet long. The dryer is placed at an angle of about thirty degrees with the horizontal. At the lower end is a hole to admit the top of a closed stove. The dryer contains six tiers of trays, with six trays in each tier. At the top end are a ventilator and a door by which the ventilation can be controlled. The trays are shallow wooden frames about thirty inches square with floors of fine wire gauze. Some locally made trays have floors made of wicker-work. Each dryer will dry five hundred bananas in twenty-four hours.

The whole fleet of cutters and dryers can be made locally at comparatively small cost and can be increased indefinitely.

In the process of manufacture, the fruits are cut from the "hands" and peeled by a Chinese coolie using a special knife. A Chinese boy then slices them in the slicing machine. The slices are laid in the drying trays and are dried for a few hours in the sun to remove part of the moisture. The trays are then put into the top end of a dryer and kept at a temperature not exceeding

fifty degress Centigrade for twenty-four hours. The finished trays are then removed from the lower end of the dryer.

When the dried slices are sufficiently desiccated they are ground into flour which is sifted through a fine mesh sieve and packed in locally procured tins containing a half kilogramme each. The tins are packed in cases containing sixty tins each.

The average production is twenty per cent by weight of flour from the fresh fruit, including the skins and the stalks of the "hands."

## Approximate Cost of Production.

On a large plantation, the cost of the bananas would be considerably less than when bought in the open market, the cost of the fuel would be practically nil and transport costs would be reduced when the flour is tinned. Against this we have the costs of planting up a banana estate from jungle. The cost of felling jungle at the present time varies from $12 to $18 per acre, largely depending upon the density of the jungle. The following is an estimate prepared in 1924.

For planting 10 ft. by 10 ft. = 435 banana suckers per acre.

| | | |
|---|---|---|
| Felling jungle | ... | $10 per acre |
| Clearing and burning | ... | 2 ,, |
| Holing (extra size) | ... | 15 ,, |
| Planting | ... | 5 ,, |
| | | **$32 per acre** |

In this estimate the cost of suckers and manuring (in the case of the second crop) is not included. Weeding charges would average $2/- per acre for the first six months and $1/- per acre per month afterwards.

A leguminous cover crop would have to be established to retain as much moisture as possible.

The crop from Pisang Tandok is ready for harvesting within one year of planting the suckers, and the yields per acre have been estimated as follows:—

Say 400 plants bearing 400 bunches at 30 fruits per bunch = 12,000 fruits per acre.

The yield of fruit from this variety in actual numbers is less than other varieties.

The manufacturing costs covering one actual consignment of fruits in Singapore, in 1924, were as follows:—

| | | |
|---|---|---|
| 12,941 plantains (Pisang Tandok) at 1.83 cents each | | $236.82 |
| Wages 4 coolies, and one mandor for two weeks | ... | 55.00 |
| Wood fuel | ... | 16.00 |
| Motor | ... | 4.00 |

| | | |
|---|---|---|
| 986 tins at 4 cents each | ... | 39.44 |
| Labels at half a cent each | ... | 4.93 |
| Tin smith at 1 cent per tin | ... | 9.86 |
| 20 cases at 50 cents each | ... | 10.00 |
| | | $376.05 |

From the above consignment, 551 kilogrammes of flour were obtained and the price realised was 75 cents per kilogramme f.o.b. Singapore.

551 kilogrammes of flour at 75 cents per kilogramme = $413.25

Profit therefore is $413.25—$376.05 = $37.20.

The freight paid by the buyer of the flour cost about 14 cents per kilogramme. The total cost of the Singapore banana flour in Belgium is, therefore, 89 cents per kilogramme. The current market prices at the time in Belgium for Banana Flour from the West Indies was:—

Wholesale—6 francs per half kilogramme = 60 cents.

Retail—7.30 francs per half kilogramme = 73 cents.

This compares in 1924 with 45 cents per half kilogramme for the Singapore flour, but with increased production and experience it is possible that the cost price could be reduced, allowing a larger profit to the manufacturer in Singapore, while still providing a good margin for possible competition in the European market.

In view of the possible demand for Pisang Embun in the manufacture of banana flour, the market prices at the present time, as quoted by a Chinese dealer at Jelebu, are as follows:—

| | | | |
|---|---|---|---|
| In Titi, which is in the Jelebu District | ... | $1.80 | per picul |
| In Kuala Lumpur | ... | 2.50 | ,, |
| In Singapore | ... | 3.00 | ,, |

Taking one picul of bananas on the stalk as equivalent to eight bunches, and each bunch averaging seven hands at ten fruits per hand, the number of fruits per picul would be 560 which would be approximately twice the number of fruits per picul of Pisang Tandok. This estimate for the number of fruits per picul of Pisang Embun is a conservative one as it is a common occurrence in some districts to find bunches averaging about a hundred fruits or more per bunch which would figure out at 800 fruits per picul on the above estimate.

As compared with Pisang Tandok, the cost price for Pisang Embun fruit is considerably less than the Pisang Tandok in 1924. Estimating on the above basis, the cost price per Pisang Embun fruit would be as follows:—

In Titi $\dfrac{1.80 \times 100}{560} = .321$ cents

In Kuala Lumpur $\dfrac{2.50 \times 100}{560} = .446$ ,,

In Singapore $\dfrac{3 \times 100}{560} = .535$ ,,

Reckoning on 12,941 (see above) as the figure for a consignment of Pisang Tandok plantains in 1924 and substituting the above cost prices of Pisang Embun per fruit for the cost price of Pisang Tandok per fruit, the manufacturing costs for a consignment of 12,941 Pisang Embun bananas would be as follows:—

| | | |
|---|---|---|
| In Titi | ... | 12,941 × .321 = $41.54 |
| In Kuala Lumpur | ... | 12,941 × .446 = $57.71 |
| In Singapore | ... | 12,941 × .535 = $69.23 |

From the consignment of 12,941 Pisang Tandok plantains in the 1924 estimate, 551 kilogrammes of flour were obtained. This consignment of 12,941 Pisang Tandok plantains represents about twice the amount by weight of a similar number of Pisang Embun bananas. The fingers of Pisang Tandok measure about one foot long and two inches in diameter as compared with the fingers of Pisang Embun which are from six to eight inches in diameter. In order, therefore, to produce 551 kilogrammes of banana flour from Pisang Embun bananas it would be necessary to have approximately 12941 × 2 = 25882 bananas of this variety. The manufacturing costs—taking the Singapore estimate given above as a basis—would be as follows, allowing another $30 for the extra labour involved and assuming the same percentage weight of flour is obtained from the two varieties.

| | | *In Titi* | *In Kuala Lumpur* | *In Singapore* |
|---|---|---|---|---|
| 25,882 Pisang Embun bananas | ... | $83.08 | $115.42 | $138.46 |
| Wages, 7 coolies and one mandor for two weeks | ... | 85.00 | 85.00 | 85.00 |
| Wood fuel | ... | 16.00 | 16.00 | 16.00 |
| Motor | ... | 4.00 | 4.00 | 4.00 |
| 986 tins at 4 cents each | ... | 39.44 | 39.44 | 39.44 |
| Labels at half a cent each | ... | 4.93 | 4.93 | 4.93 |
| Tin smith at 1 cent per tin | ... | 9.86 | 9.86 | 9.86 |
| 20 cases at 50 cents each | ... | 10.00 | 10.00 | 10.00 |
| | | $252.31 | $284.65 | $307.69 |
| 551 kilogrammes at 75 cents per kilogramme | ... | $413.25 | $413.25 | $413.25 |
| Profit | — | 252.31 | 284.65 | 307.69 |
| | = | $160.94 | $128.60 | $105.56 |

The profit per acre as realised in Singapore in 1924 from Pisang Tandok flour, allowing 400 plants per acre and 30 fruits per bunch was

$$\frac{37.27 \times 12000}{12941} = \$34.56$$

The profit per acre from Pisang Embun flour, taking the figures as given by a Chinese dealer in bananas at Jelebu would be approximately as follows:—

*In Titi.*

$$\frac{160.94 \times 28000}{25882} = \$174.11$$

*In Kuala Lumpur.*

$$\frac{128.60 \times 28000}{25882} = \$139.12$$

*In Singapore.*

$$\frac{105.56 \times 28000}{25882} = \$114.20$$

These figures show a considerable profit per acre, where the manufacture of banana flour is carried out near the centre of production, as compared with the following approximate estimate of profits per acre, per annum obtained by selling the fruit in the open market.

| *In Titi.* | *In Kuala Lumpur.* | *In Singapore.* |
|---|---|---|
| $90.00 | $125.00 | $150.00 |

The figures given for the banana fruit sold in the open market do not include the cost of upkeep (which would be about 20% of the profits per acre per annum) and transportation charges, therefore the profit would be considerably less as regards the Kuala Lumpur and Singapore figures which would be reduced by at least 25% and 40% respectively, for transportation alone, owing to these places being long distances from the centre of production which in this particular case is the Jelebu District.

The above figures are purely rough approximations but a sufficiently wide margin has been left so that they will not be misleading. As compared with the profits which have been made in the past in banana growing, the above are conservative estimates, although it must be understood that these profits are not obtainable until about the third year, only a small profit being made during the second year owing to considerable initial expenditure, such as opening up and preparation of the land. The following quotation refers to the profits which have been made in the cultivation of the Chinese banana *(Musa cavendishii)* in Trinidad (the variety is the same as the Pisang Serendah in Malaya).

"From a field of Governors of five acres planted in 1904, which had received a dressing of 40-50 tons of pen manure per acre in 1908, the heavy return of 4,596 stems was reaped or 919 per acre, and as our stems shipped for the past year netted the low average of 21½ cents each on the market, even this small price will show a return of nearly $200 (Gold) per acre, while our average expenditure for the year was slightly under $40 (Gold) per acre."

## Uses and Possible Markets.

**Banana flour can be used with milk and sugar to make a food for invalids or children. A Singapore doctor considers the flour very nourishing and easily digestible. It can also be used, mixed with wheat flour, for making cakes and puddings, for flavouring chocolate and for similar confectionary purposes.**

At the meeting of the British Medical Association in July 1910, Dr. Eric Pritchard* recommended the use of banana flour in infant feeding. He stated that it was cheap and wholesome, rendered the milk more digestible and possessed a high nutritive value. He has for many years recommended the addition of mashed banana to the milk mixtures with which babies are fed when the natural source is unavailable. As the result of further experiments, he proposes the substitution of banana flour, made into a gruel or decoction, for the more expensive proprietary infant foods. It is of great importance that infants should be trained early to digest cows' milk. This cannot be done by giving them artificial substitutes which are predigested. The use of cereal decoctions and solution of gum or gelatine undoubtedly makes the digestion of cows' milk easier, and Dr. Pritchard finds that a decoction of banana gruel has many points of recommendation. It can be made in a few minutes by rubbing up a heaped table-spoonful (1 oz.) of banana flour with a pint of water, and then boiling for five minutes. A gruel made in this way has excellent colloidal properties when added to milk in equal quantity; it thickens the milk and prevents formation of a leathery coagulum of casein, and satisfies the appetite of hungry infants more effectually than simple milk dilutions.

Banana flour can be obtained under the name of "Bananine," of which the Lancet† speaks highly in the following terms:—

"There can be no doubt of the nutritious character of banana flour, and the starch in it is peculiarly easy of solution and digestion in the alkaline digestive juices of the body. Banana flour is readily dissolved, for example, by the saliva. Our analysis of 'Bananine' gave the following results:—Moisture 14.60 per cent; mineral matter 2.20 per cent; proteid 19.22 per cent; fat 2 per cent; and carbohydrate 61.98 per cent. The flour has the peculiar flavour and odour of fresh banana fruit. We have received also a sample loaf, made with 'Bananine' flour. The flour proves to make a very acceptable loaf, uniform in texture and permanently moist and of a golden colour."

It has been difficult to make banana bread unless the banana flour is mixed with a large proportion of wheat flour, but bread of an agreeable taste has been obtained by making a paste of the banana flour, and then submitting to the action of steam under pressure.

"Bananine" is prepared by a Liverpool firm, the Banana Bread Flour Food Ltd., 16 Brunswick Street. Banana Flour and other banana preparations are also manufactured by Pattinson Banana Fruit Foods, Ltd., Anerley, London, S.E. The banana flour is vouched for in their circulars as follows:—"Dr. Conrad Stich, the food expert of Leipzig writes: 'I have carefully analysed and tested your banana flour, and have noticed how peculiarly soluble it is. By the addition of hot water the whole of the flour is made perfectly soluble and in a form suitable for digestion. Four-fifths of the flour consists of

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* British Medical Journal, October 15, 1910.

† The Lancet, October 17, 1903.

soluble carbohydrates. It is particularly suited for patients recovering from typhoid fever, and is excellent in cases of Choluria, dysentry, and similar stomachic complaints. In cases of chronic dyspepsia and gastritis, the banana flour properly prepared is easily digested. I consider that as an infants and invalids food the flour properly prepared has a great future. The nitrogenous portion of the flour is of great value, being of a fruit nature and remaining quite soluble in the flour."

In 1924 there was a considerable market for the flour in France and Belgium. A Norwegian firm of good standing applied for the sole agency for the banana flour from Singapore. Japanese landowners at Batu Pahat proposed the formation of a joint company to produce the flour from plantains grown by them. When this proposal was not agreed to, they offered to purchase the existant factory, but this proposal also was not agreed to. The proposals made, however, indicate the possibility of a market in Japan, and possibly a market could be found in China, Australia and perhaps India.

It appears that in 1924, the Banana Flour industry offered definite possibilities. The cost of the plant is not very high and at the same time it could be run economically if, for instance, the heat from the flues of the banana dryers could be used for drying copra in areas where coconuts are abundant, in which case the coconut husk could be used for fuel. The markets for the flour then existant were probably limited but appeared to be capable of extension.

The main difficulty in 1924 was to obtain an adequate supply of fruit and to avoid an unfair rise in prices. If an area of land could have been obtained in a favourable situation near a port in the Peninsula to grow sufficient plantains to keep the factory running, it would have proved a more suitable site than the factory in Singapore Island.

Later advices from Belgium showed that if the production of banana flour in Singapore was to prove successful the cost of production must be reduced. The cost of fuel and transport were on the high side, but the very high cost price of the fruits proved the bar to successful manufacture in this particular instance.

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# THE SCHOOL OF AGRICULTURE, MALAYA.

BY

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It is now common knowledge that a School of Agriculture is to be established in the near future at Serdang, near Kuala Lumpur, as a joint institution for the Federated Malay States and the Straits Settlements. Proposals for such a School are, however, by no means of recent origin, for both the Department of Agriculture and the Education Department have, during the past fifteen years, repeatedly urged the necessity of providing facilities for educating the inhabitants of this country along agricultural lines. That this necessity has existed for a number of years is evident from the findings of a Committee which was appointed by the Federal Government as long ago as early 1914 to consider the desirability of establishing locally a College of Tropical Agriculture. The Committee was not favourably disposed towards the suggestion, with the result that the projected institution eventually materialised not in Malaya but in Trinidad, as the Imperial College of Tropical Agriculture. It was considered that there was at that time a far more urgent need in this country for a system of agricultural training which should start at the bottom and work gradually upwards: in other words, that the demand for higher training of the standard associated with an agricultural college was insignificant in comparison with the very real and urgent need for such elementary and intermediate forms of instruction as lie within the province of an agricultural school and which, under efficient organisation, might reasonably be expected to lead in the course of a few years to a steady improvement in the standard of agriculture as practised by the native Malays and other Asiatic agriculturists in the Peninsula. The views expressed in 1914 were unquestionably sound; but, unfortunately, the proposals submitted by the Committee were destined to encounter obstacles which were as serious as they were unforeseen. The Great War broke out in the same year; and, with the general upheaval and financial uncertainty which followed, it is but natural that the recommendations were not put into practice, in spite of their sound foundation.

The desirability of providing facilities for agricultural education in Malaya was not lessened by the non-acceptance of these original proposals, although some years elapsed before they were revived. The Director of Education visited the Dutch East Indies and the Philippines in 1917 in connection with the question of industrial education, and was much impressed by the prominence given in Java and elsewhere to agricultural training. Further, in 1921, an officer of the Department of Agriculture visited Ceylon in order to study the conditions of agricultural education which obtain in that country; and, on his return to Malaya, submitted proposals for the establishment of a Central School

of Agriculture for the purpose of training not only Malay Officers in the Department of Agriculture but also the sons of well-to-do landowners of Malay and other nationalities. The proposals were again destined to prove unacceptable, however, owing to the financial economies necessitated by the general trade depression of 1921-22.

It is nevertheless evident that, by this time, the necessity of providing technical education, not only in agriculture but in other industrial directions as well, was developing a more and more serious aspect. The situation, in fact, had become acute by 1925, in which year the Technical Education Committee in Singapore reported as follows:—

"Though agricultural education is commonly differentiated from technical education, the importance of agriculture in the development of Malays must be our excuse for urging the need for one or more Agricultural Schools where all the operations of rubber planting can be taught to local boys so as to enable them to take charge at any rate of small estates with knowledge and success. Soil amelioration, planting, the diseases of trees, the preparation of latex, estate book-keeping, estate health will occur to everyone as essential subjects of the curriculum. A course in poultry-farming would be valuable. As we have already remarked, the Federated Malay States are geographically the centre for agricultural education. And we are of opinion that the Colony should co-operate financially with the Federal Government in any scheme which it may have for a school of practical agriculture provided students from the Straits Settlements are admitted. If the Federal Government is not prepared to co-operate, then the Agricultural and Education Departments should be required at once to draw up a scheme for this type of education in the Colony. In our view............it is the most important educational need of the moment. Not only should it provide careers for many youths, but it should help to save many thousand acres of native rubber from destruction."

Anyone familiar with Asiatic small-holdings in Malaya will agree that, so far as rubber is concerned, their "destruction" is a very remote contingency. Nevertheless it will be generally admitted that they do present considerable opportunities for all-round improvement; and, following the above report, a Committee was appointed by Government in 1926 to draw up a scheme for a School of Agriculture as a joint institution for the Federated Malay States and Straits Settlements. The Committee was composed of the Secretary for Agriculture, the Director of Education, the Chief Inspector of English Schools and the Agricultural Economist; and in its report, which was tabled as Federal Council Paper No. 12 of 1927, the existing position of agricultural education in Malaya was analysed, and definite proposals were submitted for the establishment of a School of Agriculture at Serdang. It was pointed out that the existing provision for elementary agricultural education was limited to the training in rural science of future vernacular school teachers at the Sultan Idris Training College, Tanjong Malim, the encouragement of school gardens, and the publication by the Department of Agriculture of quarterly journals in Malay

and Chinese containing articles of importance and interest to Asiatic cultivators in this country; while agricultural education of an intermediate nature did not exist outside the training given at the Department of Agriculture to a handful of Malay students recruited annually with a view to filling departmental appointments on the conclusion of their training. Even the instruction given to these students was considered to be less satisfactory than it might be, the main objection being that Kuala Lumpur itself was, in more ways than one, an unsuitable centre for such an undertaking, while two years' training was considered to be insufficient for local students in view of their general backwardness when recruited.

The Committee invited the views of various influential gentlemen and of the representatives of local agricultural bodies such as the Planters' Association of Malaya as to the immediate value of the proposed school and the general nature of the instruction which should be offered, and the conclusion was reached that a School of Agriculture should be definitely established at Serdang under the control of the Department of Agriculture and that two courses of instruction should be provided: (a) a Three Years Course, calculated to give students who had passed the Cambridge Junior or Senior Local Examination a thorough grounding in the principles and practice of scientific agriculture, and (b) a Two Years Course, of an essentially practical nature, with special reference to rubber, coconuts, oil palms and such other agricultural products as might prove suitable for estate cultivation in Malaya.

The recommendations submitted by this Committee were accepted in principle by Government, and an Advisory Committee was appointed to investigate in detail the manner in which the proposals should be put into effect. The choice of site presented little difficulty, an area of nearly 40 acres being placed at the disposal of the School at the entrance to the Government Experimental Plantation, Serdang, about 14 miles from Kuala Lumpur. The jungle was soon felled, burnt and clean-cleared, leaving an almost square area of flat land ideal for the erection of the school buildings, the establishment of cultivation plots, and the provision of playing fields. It was eventually decided that the building programme should be undertaken by the Public Works Department. Preliminary plans were prepared and were approved early in 1929 for a school and hostel suitable for the accommodation of eighty students: the school to comprise four lecture rooms, two laboratories, museum, library, and offices, and the hostel containing four large dormitories, a students' common room, and the necessary dining room and kitchens. Quarters for the school staff were actually in course of erection by August, 1929, while the building of the school and hostel was begun in January, 1930, in anticipation that the school should be opened about the middle of 1931.

Meanwhile, the question of a detailed syllabus of instruction for each of the suggested courses demanded further consideration, and the Advisory Committee came to the conclusion that the original proposals relating to the junior course should be modified in certain important particulars. In the first place,

the scheme as it then stood contemplated a Two Years Course, conducted in English, with a view to meeting the requirements of estate cultivation. It is very doubtful whether such a course would make any real appeal to the people whom it is in many ways most desirable to benefit, namely the Malay raiat and the poorer Chinese and Indian agriculturists, on account not only of the language difficulty but also the expense to individual students which two years' residence at Serdang would entail. It was felt that the junior course should be of such an elementary nature as could be assimilated by the owners of kampongs and small estates, that the instruction should be conducted in the vernacular, and that the syllabus should be covered if possible in a period of one year. The proposed amendments appeared at first to be open to objection in that students of non-Malay origin are unable to read and write the Malay language; but, on examination, this difficulty was found to be not insuperable, for such students are perfectly capable of speaking Malay and therefore of understanding both lectures and practical work, while any written matter could be undertaken simultaneously in both English and Malay. On the whole, the One Year Course appears to have everything in its favour, not only from the point of view of the private student but also in relation to the training of certain minor Government officials such as padi inspectors and overseers on agricultural demonstration stations. The proposed substitution of a One Year Course for the Two Years Course has not, at the time of writing, been formally approved by Government; but an appropriate syllabus has been drawn up in readiness, comprising such subjects as Nature Study, Animal Study, Field Crops and Elementary Principles of Agriculture; while there would in all probability be time also for some carpentry and metal-work, arithmetic and office routine, to say nothing of a series of lectures on the agricultural geography of Malaya and neighbouring countries—a subject on which even advanced students in Malaya appear to be lamentably ill-informed.

In fact, the proposed syllabus partakes essentially of the nature of the Farm School courses which have already proved successful in Java, Ceylon, Mauritius and elsewhere. In relation to such Farm Schools, however, it should be observed that they should be small and that one such school is unlikely to prove sufficient for a country of the size of Malaya. The desirability of providing at no distant date a number of such schools at various centres in the Peninsula is clearly indicated, and a project for expansion in this direction is already under consideration. It is felt that, once the course at Serdang has had the opportunity of proving its value and popularity, similar schools should be established in Perak, Negri Sembilan and Pahang.

The proposed Farm School course should not be confused with the Three Years Course at the School of Agriculture, which will aim at providing a more profound training and is in consequence applicable only to more advanced students. A course of this nature involves a certain amount of instruction in the pure sciences, such as Chemistry, Physics and Botany, upon which the whole of agricultural science depends.

The value of pure science as a foundation to agriculture, generally neglected in the past, is rapidly being appreciated now-a-days in the majority of agricultural countries, both temperate and tropical. But the subject matter cannot be taught in such an unscientific language as Malay, and the only convenient medium for instruction is therefore English. The present day student in this country, even when he has negotiated the Cambridge Junior Local Examination, is almost entirely ignorant of science in any shape or form, and it will take some years before the laboratories which have been erected in certain local secondary schools during the past three years can turn out students with even an elementary understanding of the fundamental principles of Chemistry and Biology. Meanwhile, the School of Agriculture itself must supply the deficiency.

For the more advanced students who are expected to avail themselves of the major course, the proposed syllabus may be roughly divided into three periods: Science, Agricultural Science, and Scientific Agriculture. Examined in detail, this means that the first year should be devoted to Chemistry and Physics, Botany, Zoology and Mathematics, so far as the class-room is concerned; the second year would introduce subjects such as Mycology and Entomology, Plant Breeding and Propagation; while the third year would be free for detailed work on tropical crops, and for such subjects as Agricultural Economics and Law, Animal Husbandry and Veterinary Science, Estate Sanitation and Hygiene. Throughout his three years at the School, each student would be required to maintain his own cultivation plots, on which quick-growing crops like vegetables could be grown under more or less the same conditions as obtain in school gardens; while practical instruction in carpentry and metal-work could be included as suggested for the minor course.

The above rapidly sketched syllabus represents the existing proposals of the Advisory Committee in relation to the Three Years Course at the School, and, in conjunction with the minor course, should provide a sound education not only for Asiatic officers of the Department of Agriculture but also for a large number of private students with agricultural interests in this country. Success will naturally depend upon the provision of a capable and adequate staff, working under the guidance of an efficient administration. Granted these conditions, it would appear not unlikely that Malaya wiil possess an Agricultural School second to none in the British Tropics, and that considerable expansion will prove desirable at no distant date.

# REJUVENATION AND REPLANTING OF RUBBER AREAS.

BY

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*Acting Director, Rubber Research Institute of Malaya.*

The terms "rejuvenation" and "replanting" are both frequently used to indicate the problem of replacement of old low yielding rubber trees with material of superior yielding qualities. The word "rejuvenation" is more strictly applicable to the improvement of existing areas in which a certain amount of supplying in addition to treatment of soil is to be carried out. The term "replanting" should be applied if old trees are to be completely removed and the area is to be replanted with new seedling or buddings.

In view of the high yielding material now available in the form of budded rubber trees, the problem of replanting of old areas of rubber is being seriously considered by companies who have no available jungle reserves.

The important factors in this problem are three:—

(1) The probability of yields from "proved clones" amounting to 1,000 to 1,500 lbs. per acre.

(2) Poor yields from old areas due to soil erosion, soil impoverishment from previous crops, or to bad tapping causing poor bark renewal.

(3) The incidence of root disease in old rubber, which is considered by most plant pathologists to be the limiting factor in the life of a considerable proportion of the oldest rubber.

It is not proposed in this article to consider the problem of supplying, since in old rubber the supplying of small patches on which the old trees have been removed on account of disease or for other reasons cannot be considered satisfactory on account of the shade and root competition of the surrounding old trees.

There appears little doubt that the most satisfactory method is the complete removal of the old trees, so that a block can be entirely replanted with the high yielding material available.

## Treatment of Old Trees.

A programme must be carefully laid down, so that all the possible latex can be obtained from the trees, on the areas to be planted, before these trees are removed.

No hard and fast rules can be laid down, since the tapping system, in respect of the number of cuts and height of tapping will depend on the bark available and on the period which will elapse before it is decided to remove the trees.

Methods such as the scraping of the bark to induce a greater flow of latex over a short period will be found useful. In some cases, by intensive tapping, it is possible to obtain the previous annual crop within a period of three or four months.

## Removal of Old Trees.

The cost of removal of the old trees will depend on a number of factors—(1) the size of the tree, (2) the method of removal, by hand labour or mechanical stumpers, (3) the possibility of sale of the wood from the old trees, (4) the conversion of the old wood into charcoal for sale.

These factors will depend entirely on local circumstances. On an area of 200 acres in Malacca, visited by the writer a few years ago, the felling, clearing and planting of the new material cost practically nothing, since the Manager was able to arrange a contract for the conversion of all the old wood into charcoal.

On the site on which the charcoal pits were constructed, the subsequent growth of the rubber was excellent and stated to be in advance of the general growth of the trees on the rest of the area. An addition of superphosphates was found to be of benefit.

The chief disadvantage of the removal of all the wood is that valuable fertilising material, especially potash, is removed from the area. In any case, if the wood is burnt on the spot, it should be stacked and burnt in big heaps, preferably if possible, on paths, roads or land not suitable for replanting since the burning of the wood causes soil sterilisation and further destruction of valuable humus. The ash, however, which contains valuable potash, should be distributed over the land.

## Cultivation.

On areas on which the trees have been removed on account of root disease, the complete removal of all laterals and stumps is very desirable, while the soil should be cultivated to a depth of 1 to 1½ feet. On areas which have suffered from soil erosion or soil impoverishment, it is extremely doubtful whether immediate replanting with high yielding material is advisable. In such cases, a leguminous cover crop should be established by the addition, if necessary, of artificial fertilizers—especially potash and phosphates. There is little doubt that one of the most suitable plants for this purpose is the Giant-Mimosa—*Mimosa invisa*. Although there is considerable prejudice against this plant in Malaya, the writer has seen excellent rejuvenation and regeneration of poor soils with this cover plant both in Java and Sumatra. In order, however, to keep the cover in check, periodic rolling is advisable to flatten the growth. In Sumatra, the coolies are provided with boots and carry out this operation successfully with an old oil drum. This applies, of course, only to flat or very gently undulating land.

It is also certain that, in most old areas in Malaya, a manuring programme from the commencement is desirable, and on this point the advice of the Rubber Research Institute should be sought.

Previous to planting, unless there is a special reason for hastening this, the area according to its configuration should be bunded or terraced.

On even absolutely flat land, when the soil is of loose texture (this does not apply to the heavy coastal alluvial clay soils) bunding should be adopted in order to conserve rainfall and to prevent soil movement. In Sumatra, at the present time, the most intensive bunding is being adopted on most rubber estates. The material from the bunds is derived from the digging of pits. These pits are similar to the ordinary silt pits, but are dug only to provide soil for the bunds.

Where it can be established, it would appear that the most satisfactory "permanent" cover crop at present is *Centrosema pubescens*. This should be established as early as possible on the bunds in order to protect them from erosion.

The problem of cover crops *versus* clean weeding on areas to which fertilisers are applied is still a debatable point owing to the competition for the fertilisers of the cover crop with the rubber plant. In the long run, however, any fertiliser applied in the presence of a cover crop will become available for the rubber tree.

In any case, the permanent cover crop should be planted in strips between the rows. Small quantities of fertiliser can then be used in the planting holes by thoroughly mixing the fertiliser with the soil used for filling the holes, so that the young rubber plant will receive an early stimulus. If applied in this manner, the rubber plant will be able to absorb the fertiliser.

The establishment of a cover crop is of great importance in providing additional humus and also in maintaining the soil at a lower temperature.

On areas on which root disease has been prevalent, it is also advisable to dig in 1½—2 tons of lime per acre when the cultivation of the soil is carried out.

## Planting Material and Spacing.

At this date, the only suitable material for replanting areas which have suffered from soil impoverishment, due to erosion or other causes, and to root disease, is buddings of "proved" clones. A few years ago the close planting of seedlings or stumps from ordinary seed or from seed from a high yielding area, with subsequent thinning out, based on early test tapping, would have been recommended. Even more recently, the planting of alternate buddings and plants from so called "selected" seed would have been advised.

At the present stage of our knowledge, however, mixed buddings only are recommended, using material from the best "proved" clones, that is, budwood obtained from clones which have the highest yield records over the longest

tapping period, provided that no undesirable characters have developed in such clones.

Possibly at a later stage, pure plantings of buddings of one clone on definite areas may be recommended for replanting programmes.

At the present time there are about six clones available which have a fairly long tapping record and which have not developed any undesirable characteristics. Other promising clones with a shorter tapping record are also available. On account of our knowledge of the yielding capacity, growth and bark renewal of buddings, it is not recommended at this date to replant with "selected" seed so that a much smaller number of buddings per acre can be planted than in the case of "selected" seed, since the subsequent thinning out of the replanted area will be on a low scale.

It is not advised to mix too many clones,—a selection of six of the best clones recommended is advised as a maximum. A spacing of 20 ft. x 20 ft. is suitable.

## Cost of Replanting.

No definite figures can be given to cover all cases, owing to the number of factors involved. It should, however, be possible on most areas to replant at a cost of £25/- per acre and to bring the area into bearing for £35/- to £40/- per acre. It is not a difficult problem therefore to estimate the period during which the loss of yields from the old area will be covered by the yield from the new planting. The rate at which replanting is carried out will depend on the material available for replanting, i.e. the establishment of nurseries for stock and the establishment of multiplication nurseries for the supply of budwood. It would be uneconomic to purchase budwood at high prices for planting the areas. It is preferable to establish multiplication nurseries for the supply of such budwood. On this account, a scheme should be worked out in detail before being put into operation so that the necessary amount of budwood is available for the area to be replanted in any year. Advice and information on this can be obtained from the Rubber Research Institute.

## General.

At the present time, large areas both in Malaya and in the Netherlands East Indies are being planted with buddings which are expected to yield in the 8th to 10th year at the rate of about 1,000 lbs. per acre. It will be impossible for many of the old areas at present in existence to compete with such yields. The old areas will also progressively decrease in production, due to disease and other factors while the new areas, planted under modern conditions with high yielding material will progressively increase in production. On all estates, therefore, on which the trees are definitely known to be a wasting asset, the problem of replanting must be considered. Even where a company has reserve

jungle on which to plant high yielding material, it is advisable to adopt a progressive replanting scheme, since with proper treatment the replanted areas will soon more than repay for the treatment adopted. Only on a few areas, on which the surface soil has practically disappeared due to erosion, is a replanting scheme not advised. The only possible treatment for such areas is a rejuvenation or reconditioning of the soil by the planting of a cover crop such as *Mimosa invisa*. It is not possible to state definitely how long it will be necessary to allow such areas to remain under a cover crop before they will be of value for replanting.

We are only concerned here, however, with the replanting of areas which are becoming uneconomic on account of the following factors:—

1. Early methods of planting without selection of planting material.
2. Late thinning out.
3. Bad methods of tapping and poor bark renewal.
4. Root diseases due to lack of suitable treatment in the early stages of growth of the plant.

The planting of high yielding material combined with modern methods of soil conservation, the cultivation of a suitable cover crop and a system of manuring, renders the replanting of such areas an economic and commercially practicable proposition.

# SELECTED ARTICLES.

## RUBBER, COFFEE AND TEA MARKETS IN 1929.*

### Rubber.

The rubber plantation industry has passed through one of the most critical years in its history, due to the uncertainties and unknown factors brought about by the aftermath of a restriction scheme lasting six years, which came to an end on November 1 a year ago. The average daily price for this year will not be better than 10d. per pound, which compares with 10¾d. for the whole of last year. The highest price during the year for spot delivery was 1s. 1¼d. in February, a sharp rise due to speculative operations taking place, but "bear" sales and adverse statistical features caused liquidations of forward positions from time to time, and the lowest level since April, 1928, of 7½d. was reached in November.

Production, in terms of shipments from the East, have been exceptionally heavy and in excess of all market estimates owing to extremely favourable climatic conditions prolonging the natural "flush," the result of the enforced resting of trees during the restriction period. In the light of exports for the eleven months to date, it is probable that production from all sources for 1929 will reach a record of 860,000 tons.

A satisfactory feature offsetting the increase in production has been the expansion in consumption from all consuming centres. Demand from America, the largest buyer, has shown an increase of 7½ per cent compared with the year before, while world consumption outside America has grown by over 50 per cent. It would appear that the total consumption for 1929 will be over 800,000 tons.

A factor depressing the price this year has been the large forward contracts entered into by many estates at prices round 8½d. per pound, London terms, with optional Continental port clauses and for New York. No forward commitments of importance have been made for next year, which is a satisfactory feature from the market point of view.

Stock position in all consuming centres increased during the year, as the large accumulations in the East, which were previously unexportable, found their way into stocks, and the larger monthly shipments on the resumption of unrestricted output by estates have been higher than the market could cope with............The outcome of low prices has been more scientific and economical working of estates, making for lower costs all round, so that many companies are able to show fair profits with the commodity at anything over 8d. per pound. It is possible to take a more favourable outlook for next year, allowing for consumption being maintained, as the absence of forward contracts makes for

* The following reviews on rubber, coffee and tea are reprinted from "The Commercial," Vol. XIX, No. 497, December 26, 1929. Published by the "Manchester Guardian."

a free market, and reduced yields are to be expected from estates after the first "flush," due to resting of the trees in all the countries of production.

## Coffee.

In common with a number of other tropical or subtropical commodities, there has in recent years been a large overproduction of coffee, but in this case the difficulties which usually follow overproduction have been rendered worse by the taxation which confronts the article at almost every point. In Brazil, where millions of British capital are invested, the Coffee Institute has tried to limit shipments in order to stabilise the price, but these attempts have broken down. Consuming markets have been overwhelmed with supplies, and prices have tumbled everywhere.

Brazil supplies most of the world's coffee, and her 1929-30 crop touches 17 million bags. One authority forecasts that the 1930-31 crop will be larger still. It is stated, however, that the Sao Paulo Government is now engaged on a comprehensive scheme to deal with the present situation with a view to the gradual liquidation of the existing surplus stocks, and it appears likely that this scheme, when published, will involve the calling for further capital investment. There is every likelihood, however, that ultimately the position will right itself by the reduction of working costs to somewhere below market values. One or two seasons of low production—and these things come in cycles—would make a world of difference to the financial position of the planting companies.

During the present year coffee production has made some progress in British Africa notably in Kenya, but on account of low world prices the enterprise has not yielded the hoped for results.

## Tea.

The close of the year finds the tea industry in a difficult position, brought about by overproduction and by the fall in the re-export trade. On the production side we had a carryover of stock from 1928 amounting to 30,000,000 lb., and in the course of the present year there has been an increase in receipts of 55,000,000 lb., so that in all we have a surplus of 85,000,000 lb. to deal with. What is more, Southern India, Sumatra and Java have large planting programmes in hand, and if these are proceeded with there is every prospect of still larger supplies.

In this year's Budget the import duty of 4d. per pound on tea was swept away, and the expectation that this event would lead to a large increase in consumption was only partially fulfilled. Burdened with stocks, the Mincing Lane market found itself unable to maintain the export trade on the basis of 1928, and much tea of medium quality was sold at about 6d. per pound. At the rates ruling in May and June the business was unprofitable to the gardens

and many lots were withdrawn. This poorness of trade was, however, confined to the medium and low descriptions, for there has been a strong demand for teas of the finest grades, which always fetch good prices.

In the hope of remedying the stock position, proposals have lately been made to restrict production. Details of this scheme were given in "The Commercial" of December 12. It is suggested that for 1930 there should be a reduction of 10 per cent based on the figures of 1928.

On the marketing side 1929 has had a rosier hue. Leaf has been cheap, and the big blending and distributing houses have taken the opportunity to recoup themselves for some of the lean years previously experienced. The re-export trade has been poor this year in comparison with 1928, but as a result of an intensive publicity campaign which is now being inaugurated in a number of countries it is expected that better things will be witnessed next year. Perhaps the most hopeful quarter is Russia, which before the war was our best customer for tea. The resumption of diplomatic relations between that country and Great Britain ought to be very helpful to the trade, and it is satisfactory to know that negotiations are now going on between the various tea producing countries by the adoption of which large supplies will be made available to Russia on long-term credits.

# THE IMPROVEMENT OF RICE CULTIVATION IN MALAYA, INDO-CHINA AND JAVA.*

*The following is a Résumé of an article on the improvement of rice cultivation by Mr. L. Lord, M.A., Economic Botanist of the Ceylon Department of Agriculture.*

During March and April, 1929, the Economic Botanist of the Department of Agriculture, Ceylon, visited Malaya, Indo-China and Java in order to study the methods adopted in these countries for the improvement of rice production. The main questions on which information was sought were:—

*(a)* The use and usefulness of pedigree seed.

*(b)* The organization of seed supply.

*(c)* Manuring and cultural practices.

*(d)* The technique of selection and hybridization.

## A. Malaya.

It is pointed out that Malaya fails to grow enough rice for the requirements of the population and that a large quantity has to be imported. Efforts which are being made to increase yields are described under two heads: first and chiefly, the selection or breeding of improved seed and its dissemination among cultivators; and secondly, the demonstration and encouragement of manuring. The work of seed-selection and hybridizing is carried out by the Division of Economic Botany in the Department of Agriculture, S.S. & F.M.S. There are two rice selection stations, the chief of which, and the one where almost all of the selection work has been done is at Titi Serong in Perak and has an area of 21 acres. The other is in Malacca and is 26 acres in extent. In addition, there are test and multiplication stations in other rice-growing areas of the Peninsula. The average size of these stations is 4—5 acres.

The pedigree selections already made and tested at Titi Serong are again tried at the test stations for a number of years, after which suitable selections are distributed to cultivators.

The methods of pure-line selection employed differ only in detail from those adopted in Ceylon. For example, in Malaya, lines are selected on a basis of yield per plant, rather than yield per panicle as in Ceylon. The question of the comparative utility of the two methods is being investigated, as in Ceylon, profuse tillering is not always desired. Bagging is not resorted to for maintaining purity of lines, but this is ensured by growing three lines of plants of each selection and using the seed of the middle line only for continuing the selection. Seed of the outside lines is used for multiplication plots. Pedigree

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* The Tropical Agriculturist, Vol. LXXIII, No. 6. December 1929.

selections are tested in small plots replicated sufficiently to detect 10% differences in yield. In the Krian district the standard error of a single plot of 1/40 acre is 7.6% and if 1/20 acre, 6.6%. Test plots are always situated well away from the bunds. The random arrangement of plots with replication in compact blocks is not used in Malaya; nevertheless the standard errors are very similar to those in Ceylon.

Crosses are now being made of different pedigree selections at Titi Serong.

Manuring experiments are being conducted at five stations, but the results have not yet been published. It is considered, however, that manuring as a means of improving the yield of rice has great possibilities.

## B. Indo-China.

The position of the rice industry in Indo-China differs radically from that of Ceylon and Malaya in that it is a large rice-exporting country, in fact, its exports are only exceeded in quantity by Burma. In view of this important point, the problem of the improvement of yield per acre, which is the chief object of the work in Ceylon is, in Indo-China, considered of less importance than the quality of the grain. As most of the rice is exported, evenness of grain is wanted, not only to reduce loss by breakage in milling, but also to ensure getting the best market price.

The produce of the cultivators' fields is frequently a mixture of varieties varying in size of grain so that it is difficult to get large quantities of padi reputedly of one type. This difficulty is increased by the habit of Chinese buyers of mixing different lots before sending them to the mills.

Unless the crop from selected seed is heavier, or unless it commands a premium on account of its evenness, there is no incentive to the cultivator to grow the seed.

Whilst pedigree breeding and manuring are receiving attention, the mechanical selection of seed is another line of improvement which is foreign to Ceylon. As the cultivators' seed is invariably a mixture of types differing in size of grain, it is put through a mechanical grader which separates the main types. The type desired is retained and distributed to cultivators. This seed is not, of course, a pure line seed as it may consist of a number of varieties, but in size of grain it is homogeneous. It is not thought that mechanical seed-selection can be of any use in Ceylon, because pedigree seed will fulfil all requirements.

Crosses between a Carolina rice and a local pure line have been made. Some of these are promising and certain of them, which were breeding true, have been selected for multiplication and testing.

The statement is made that it is comparatively easy to produce a satisfactory pedigree selection, but it is extremely difficult to ensure that seed of the selection gets into the hands of the cultivators periodically and in sufficient quantities.

It is a problem whose detailed solution must vary in different countiies, and India must be looked to for guidance on this point.

## C. Java.

The difference in the rice industries of Ceylon and Java is seen in the following figures:—

Whereas Ceylon in 1924-27 had an average importation of 84.1 k.g. per capita, that for Java in 1922-25 was 7 k.g. only. In 1926 and 1927 imports into Java fell with the decline in exports of high quality rice. Consumption, per capita, in the two countries did not differ greatly.

The 8,256,000 acres of rice land in Java yielded an average of over 1,300 lbs. of padi per acre. In Ceylon, the average area of 792,000 acres for the years 1921-25 is shown as having an average production of 634 lbs. per acre. The Ceylon figures, however, are admittedly open to a large error for various reasons.

In Java, not only is the soil fertile, but the irrigation systems are excellent. The soil is also suitable for dry crops, and on most land, rice is rotated with maize, soya-beans and ground-nuts as well as with sugar-cane. This rotation of crops is certainly responsible for increasing the yield of rice. On the much less friable padi soils of Ceylon the practice of a rotation is difficult, or impossible.

The pure-line selection of rice in Java has not yet been particularly successful and several reasons are adduced to account for this; for example, it was found that seed selected under the particular soil and climatic conditions of the chief station at Buitenzorg behaved differently in other areas, and that cross-pollination was by no means negligible.

Three selection stations on the main soil types are to be established, whilst a fourth, on a laterite soil of volcanic origin, will be formed at Buitenzorg. The selected seed after being thoroughly tested will be multiplied in about 60 small farms of about 7-9 acres each. After being tested in these small areas it will be tested and multiplied again in larger areas known as 'multiplication fields' before being distributed to cultivators.

In the actual work of selection, bagging will be adopted to ensure the purity of the lines. The importance of carrying out selection work on the particular soil type for which seed is desired is stressed.

The amount of seed at present distributed is negligible, and there is no co-operative or other agency for such distribution.

In regard to the manuring of rice, it has been found that phosphatic fertilizers on many soils give large increases in yield. On some soils nitrogen has also proved of value. In spite of the increases in yield which can be obtained, the consumption of artificial fertilizers is small, due to the great want of money of the native farmer for whom an adequate form of agricultural credit is essential.

Sugar is grown on a large scale on rice land rented from native cultivators for one year in three or four.

In an editorial in the same number of the publication the following paragraph occurs. As the remarks made apply equally well to Malaya they may be usefully quoted here:—

> "The wide use of pedigree seed alone will never enable Ceylon to grow sufficient rice for her needs. Pedigree seed will help, but so will the use of manures, and, as was suggested in this journal for August, manuring has the promise of being the best method of rapidly increasing yields. But even if the correct manuring practice is known and the best pedigree seed is available, the problem of sufficiently increasing production is by no means solved. There are, for example, the following factors to be considered among others: the supply of credit for purchasing seed and manures, and the efficient distribution of these. There is the factor of malaria, especially where new land is to be brought under cultivation, and there is the very important factor of water. Without an adequate supply of water, good seed and manures are useless, and in many districts dependence solely on rainfall makes rice cultivation pitiably precarious."

W.N.S.

# REVIEWS.

## Sisal.

## Production and Preparation.

*Edited and brought up-to-date by H. Hamel Smith.*
*(London. John Bale, Sons and Danielsson Ltd.)*

This book consists mainly of a number of reports and memoranda, concerning the production of sisal hemp, gathered together from various countries. In addition, chapters on alcohol from sisal refuse, Colombian Pita Fibre, and an account of various machines and methods employed in the preparation of the fibre, are included. The book is divided into two parts. Part I refers in particular to Production while Part II deals with Preparation.

The first two chapters are composed of published accounts of attempts to establish sisal industries in India and Queensland. These reports, issued in 1906 and 1910 respectively, though containing a considerable amount of information, are of little use to the practical planter. Chapters follow on the cultivation of this crop, commercially and otherwise, in Ceylon, Kenya and East Africa, Malaya, Cocos Islands, Mexico, Philippine Islands, Java and Sumatra, and Cuba.

No attempt is made to apportion the amount of text in these chapters with regard to the relative importance of the sisal industry in the countries mentioned. On the contrary, Tanganyika, an important sisal producing country receives two pages only while Queensland, where the cultivation of sisal is of small account, is allotted 86 pages. The chapter on Malaya consists of extracts from a report published in the Malayan Agricultural Journal, November, 1924, Vol. XII, No. 11.

The account of sisal production in Java and Sumatra conveys little information of value. This, however, is not more than might be expected as definite data regarding the activities of the larger plantations in the Netherlands East Indies is not readily available. It is known, however, that sisal from Java is of first class quality and commands high prices.

The preparation of the fibre as undertaken in East Africa is described in some detail and conveys a useful account of this operation. This is followed by a series of descriptions by several well-known firms of their machinery, and the factory methods employed in sisal producing countries. These accounts are of considerable assistance but leave the reader in some doubt as to the relative values of the several types of machines described.

The book as a whole contains much useful information but owing to the way it is presented, the reader will have some difficulty in piecing together an account of the industry from planting to marketing.

The book contains forty-seven illustrations, which are clearly reproduced and give a good idea of sisal cultivation and preparation in its various phases. A bibliography and an adequate index are provided.

J.N.M.

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**Begemann, H. Over Schildluizen van de Koffie (Scale Insects of Coffee) Archief voor de Koffie Cultuur in Nederlandsche-Indie; Mededeelingen van het Proefstation Malang. No. 71, December, 1929, pp. 113-166.**

Three of the most important Mealy bugs and two important scale insects which attack various parts of the coffee plant are dealt with. The mealy bugs are *Pseudococcus citri?* Risso. (Witteekoffieluis or white mealy bug of coffee). *Ferrisia virgatus* Ckll. (Lamtorosluis or Mealy bug of *Leucaena glauca*), *Pseudococcus citri*, Risso, (Witte wortelluis or white root-mealy bug); *Coccus viridis*, Green. (Groene koffieluis or Green coffee scale) and *Saissetia haemisphericum*, Targ. (Bruine luis or brown scale).

Concerning *P. citri?* Risso. the author states that this species is also named the "Castilloa luis" or "Cacao luis" to distinguish it from the common "cacao luis" (*P. crotonis*). The white mealy bug which, not only in the Dutch East Indies, but also in other countries, is harmful to coffee, is still considered the same species which is also harmful to Citrus and is described as *P. citri* Risso. This species is now spread over the whole world.

Reference is made to the work of Kirkpatrick in Kenya who has shewn that the coffee mealy bug is not conspecific with the citrus mealy bug but is *P. lilacinus*, Ckll., and moreover the white coffee-mealy bug very seldom migrates to citrus trees even if they grow close to attacked coffee. The numerous predators and parasites of the mealy bugs and scales are fully dealt with. Among those mentioned are Psocidae, Hemerobiidae, Chrysopidae, larvae of the Noctuid moth *Eublemma rubra*, Hamps. and of the Lycaenid butterfly *Spalgis epius*, Walk.

Beetle predators comprise almost exclusively the Coccinellids or "Ladybirds". The most important is a species of Scymnus. The introduction of members of this family from other countries is also discussed.

The Order Diptera, or two winged flies includes some species which are important enemies. A species of Diplosis is considered the most useful. Hymenopterous parasites are represented by various members of the super-family Chalcidodea, one of which is *Leptomastix trilongifasciatus*, Girault. The influence of climatological factors on the increase of mealy bugs, the damage caused by them and control measures are discussed at length.

Control methods are grouped under four headings—cultural, chemical, mechanical and biological. Cultural methods of control comprise the high

pruning of shade trees, hygiene of the trees, and the removal of faded and dried remains of flowers.

Three types of chemical control are suggested. They are,—direct chemical control, indirect control by killing the ants which pasture mealy bugs, and the combination of both methods.

Mechanical control includes the cleaning off the mealy bugs, strewing dry sand on the berries and pruning and burning. The object of the strewing of dry sand is that it adheres to the viscid excrement of the mealy bugs and kills them. The pruning and burning method is directed chiefly against the bugs on shade trees and fences before they have migrated to the coffee.

The section "biological control" deals at length with the practicability of combating mealy bugs by the introduction of predators. Taking into account the comparatively low cost of such undertakings, the author is of the opinion that this is an economical method of control.

He adds that, while awaiting the results of further research, the surest method is a systematic control of ants to prevent their spreading mealy bugs.

The report is illustrated by many very excellent photographs.

N.C.E.M.

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## Burma Agricultural Reports

### for the nine months ending 31st March, 1929.

*Rangoon. Supdt. Govt. Printing and Stationery, Burma, 1929.*

The Burma Government has recently published a number of reports on the activities of the Burma Department of Agriculture, for the year ending on the 31st March, 1929, covering nine months. In addition to the reports of the Agricultural Engineer, Agricultural Chemist, Mycologist, Entomologist, Economic Botanist, the Agricultural College and Research Institute, and that on Sericultural Operations, detailed reports are presented of twelve agricultural stations. Three of these stations are of considerable area, but the majority range in area from 50 to 150 acres each. The total area of the stations is over 2500 acres. Many are concerned mainly with padi cultivation problems with the object of the improvement of yield and varieties suitable for export.

One of the problems on which exhaustive trials are proceeding is that of manuring padi. The fact that padi is grown in water renders this research extremely difficult, and we have yet to see conclusive results either in the records under review or elsewhere in the East, on which to base a positive policy of manuring. The Burma experiments are designed on the use of artificial fertilisers to decide whether the plant is most responsive to nitrogen, phosphates, potash or lime and conclusions on this would certainly prove a

valuable contribution to the subject of manuring padi. In most of the Burma experiments, negative or inconclusive results have been obtained, although lime and cattle manure applied together gave a notable increase on the poor soil at the Myaungmya Agricultural Station. This rather confirms the results obtained elsewhere, that padi responds to an increase in organic matter in the soil.

Among other crops mentioned in their reports it is noticed that palm oil is making vigorous growth on certain of these stations.

· In common with agricultural reports from many countries—and we do not hold ourselves blameless in this respect—these reports make frequent use of vernacular words and of local weights and measures. This is very confusing to the reader who may wish to compare results from different countries. If investigators could agree to a standard of weights and measures, would use botanical terms in addition to local names, and would avoid as far as possible, the use of vernacular words to express agricultural operations, the task of comparing results would be greatly facilitated.

D.H.G.

# FROM THE DISTRICTS.

## The Weather.

February was a hot dry month, with day temperatures above the normal. It would appear that the North East Monsoon has failed completely. The East Coast has experienced a strong east wind which now shews signs of changing to the south.

## Remarks on Crops.

*Rubber.*—Wintering has been general and rapid owing to the dry weather. Rain is now needed to bring out the new foliage. One favourable aspect of the dry weather has been in the easier control of rubber diseases. Mouldy Rot disease has not been virulent in any district, and control of such cases as have been found has not been very difficult.

There is an increasing tendency amongst Chinese rubber estate owners to rest their trees during the wintering period—a practice which is more general on the large European owned estates. Such action has had a beneficial effect on the incidence of Mouldy Rot disease. Small-holders, however, continue to tap their trees under any conditions.

*Padi.*—In the important padi area in Krian, prospects are more promising than was at one time thought probable. The areas in Briah, Selinsing and Gunong Semanggol have 10,500 acres planted, leaving 3,500 acres unplanted. Crops in this area will be light. The more important areas in Kuala Kurau, Bagan Tiang and Tanjong Piandang, where the best padi land of Krian is situated, contain nearly 34,000 acres. It is stated that these areas contain a very promising crop and the same applied to the large area in Bagan Serai. The crop, however, is somewhat late and experience indicates that it is more than likely that wet weather will attend the harvesting which is bound to result in loss of garnered grain.

A good crop of padi is likely in the districts of Kuala Kangsar, Upper Perak and the sub-district of Selama. Over a large part of Larut only a light crop can be expected.

Harvesting is in progress in Lower Perak. Rat damage has been serious in some places, but generally, yields are expected to be good.

Province Wellesley contains a considerable area under padi. Harvesting is in progress in most places, but crops are expected to be very light. This is particularly the case in the North and Central districts. Many lessees of padi land have abandoned their crops and absconded knowing that they would be unable to pay the rent due on completion of harvest.

Negri Sembilan reports state that the dry weather has hastened the ripening of padi and harvesting, where not finished, is being actively carried on.

In Malacca, the yields obtained, as anticipated, are up to average.

In West Pahang, crops have been above the very low average. The planted area this season was 11,000 acres, an increase of over 2,600 acres over the previous year.

*Coffee.*—The recent fall in the price of coffee has severely hit the Chinese growers in the Temerloh district of Pahang.

*Fruit.*—A moderate crop of langsat, durian, mangosteen and rambutan continued to be harvested in all districts in Pahang.

## Notes on Demonstration Stations and Padi Test Plots.

*Kuala Kangsar Demonstration Station, Perak.*—The old orange trees are bearing a heavy crop, but the fruit, however, is so small that it will probably be unsaleable. Four year old rooted marcots are also fruiting heavily, the fruits in this case being of normal size.

*Talang Padi Test Plot, Perak.*—At the end of the month, harvesting was still in progress. Work is slow owing to the fact that the harvest coincides with the Mohammedan fasting month. A fair crop has been produced. The pedigree strain, Serendah 741, has done better than usual; a dry season apparently suits it.

*Dong Padi Station, Pahang.*—The padi crop has been harvested, the yields being the highest since the inception of the Station. The variety, Radin 13, shews remarkably consistant results over some years and these results together with similar ones recorded from field trials by cultivators indicate the suitability of this Krian pure line to the conditions obtaining in the padi areas along the Kuala Lipis road.

*Temerloh Padi Station.*—Work of preparing the nursery beds is in hand. Varieties Seraup Kechil 36 and 52 will be replaced by Radin 13 and Serendah in this year's trials as it is considered that the Seraup varieties, by virtue of their long maturation period, are unsuited to conditions generally obtaining near the Pahang River.

*Pulau Gadong Padi Experimental Station, Malacca.*—Yield figures now available shew that some of the selected Nachin Puteh and Padi Siam strains are a distinct advance on the local padi at present grown.

## Rats.

Work in the rat campaign in the Krian padi area continued throughout the month, 12,711 rats being killed. In the Province Wellesley campaign, 66,962 rats were accounted for, and 10,000 poison baits distributed.

Rat catching was neglected in Malacca, owing to the havesting of padi and the fasting month. Considering the late start, the control obtained this season was very satisfactory.

# DEPARTMENTAL NOTES.

## Experimental Work at the Government Plantation, Serdang.

Mr. E. A. Curtler, Assistant Agriculturist, delivered a lecture on the above subject to the Taiping Branch of the Incorporated Society of Planters on the 8th February, 1930.

The lecturer pointed out that the old criticism that the Department of Agriculture confined its attention too much to one crop could no longer apply, as if such criticism was even justified in the past, it was certainly rectified when the Serdang Plantation was opened in 1920. Since then, the Plantation has developed steadily until at the present time 725 acres are opened and planted with a comprehensive collection of economic plants. Owing to the short time at his disposal, Mr. Curtler confined his remarks to but a few of the crops upon which considerable investigations have been carried out at this station. Foremost amongst such crops are oil palms, tea, coffee, sisal hemp, tapioca, tuba root, gambier, fruits and chaulmoogra oil; and in addition, live stock.

Dealing with oil palms, the meeting was informed of the nature of the experimental work on this crop, its objects, and the results obtained to date. Experiments on oil palms were concerned with the effects on the palm and on the crop resulting from artificial pollination under different conditions; on pruning; interplanting with other crops; yield under varying conditions; and factory problems.

The tea work was commenced in 1925. It has comprised a comprehensive series of variety trials, work on planting distances, and more lately, on the preparation of tea.

Coffee experiments have included variety tests, pruning experiments and the effect of various cover crops.

Very important work has been carried out on sisal hemp. Space forbids any detailed account in this place, but the reader is invited to consult back files of this journal for information on the subject. Mr. Curtler stated that small consignments of the fibre prepared at Serdang had been sent to London and had received very favourable reports from manufacturers.

Of the many burning questions of tropical agriculture, that of exhaustion of the soil as a result of tapioca cultivation is receiving attention at the Government Plantation. The effect of tapioca on the soil, and methods of keeping up the fertility of the land are the main lines of investigation.

Three breeds of cattle are represented on the Stock Farm. Work on pig breeding has also been commenced. The main idea on the farm is to use the herd of cattle as a foundation to build up a type of cow suitable for milk production in the lowlands of Malaya, at the same time keeping in view the possibility of utilising the old animals and poor type bulls for beef and the latter for draught purposes. It is hoped that it will also be possible to grade

up the local milch cattle by distributing throughout the country both Friesland and Montgomery bulls from good milking strains. Questions of food and feedings are also being investigated in all their aspects.

It is hoped that the lecture will be published in "The Planter," the official organ of the Incorporated Society of Planters.

## Leave.

Mr. F. W. South, Chief Agricultural Field Officer, returned from leave of absence on 9th February, 1930.

Mr. B. Bunting, Agriculturist, returned from leave of absence on 20th February, 1930.

Mr. J. W. Jolly, Agricultural Field Officer, returned from leave of absence on 14th February, 1930.

# MARKET PRICES.

## February, 1930.

*Rubber.*—The average London price for rubber for February, 1930, was 7.9 pence per lb., being a rise of .6 pence over the corresponding figure for January, 1930. The highest price quoted was 8¼d., while the lowest quotation was 7 7/16d. The average Singapore price was 26.25 cents, against 24.6 cents in January; the highest price being 27⅛ cents and the lowest 24½ cents per lb.

*Copra.*—Singapore prices for copra have fallen about ten cents per picul during the month. For the first three weeks of February, the average prices have been $8.86 F.M., and $9.31 S.D. per picul of 133⅓ lbs. The Singapore Chamber of Commerce reports transactions amounting to 3995 tons for the period 20th January to 22nd February.

*Coconuts.*—$3 per 100 in Singapore.

*Gambier.*—For the period 20th January—22nd February, 1930, the average Singapore price was $8.96 Bale and $15.50 Cube per picul, 97 tons being recorded by the Singapore Chamber of Commerce.

*Nutmegs.*—Singapore prices have fallen considerably, the average prices for the month being:—for 110 per lb. $43.20 per picul, 80 per lb. $44.80 per picul.

*Pepper.*—A sharp rise in prices is recorded in Singapore, the improvement in black pepper being from $43 to $50½ per picul, sales amounting to 169 tons; White Sarawak rising from $64 to $75 per picul, 179 tons being sold. The average prices for the period 20-1-30—22-2-30 were $45.81 for black, and $69.25 for White Sarawak.

*Rice.*—Siam fell from $415 to $340 per Coyan, Saigon White $240—$260; Rangoon White $252—$226, the average prices being $384.60, $253.80, $239.60 per Coyan respectively.

*Sago.*—Singapore prices—Pearl, fair $7.50—$7.25, average price $7.20; 125 tons: Flour $4.25—$4.15, average $4.20 per picul, 852 tons being recorded.

*Tapioca.*—Prices in Singapore well maintained. Flake, small fair improved from $5.50 to slightly over $6, average $5.84 per picul, 774 tons; Pearl, fair, steady around $8, average $7.95 per picul, 29 tons sold.

*Pineapples.*—$10 per 100 in Singapore.

*Bananas.*—$4 per 100 in Singapore.

The above market prices are based on the daily cabled London quotations for rubber and on the Singapore Chamber of Commerce Market Reports covering the period 20th January, 1930, to 22nd February, 1930, and from other local sources.

London quotations for other products than rubber will be discontinued owing to the inevitable delay in receiving such reports.

# MALAYA RUBBER STATISTICS

STOCKS OF RUBBER HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, TOGETHER WITH THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORT AND EXPORT FIGURES, AND ESTIMATED FIGURES OF THE PRODUCTION OF ESTATES OF LESS THAN 100 ACRES. FOR THE MONTH OF JANUARY, 1930, IN DRY TONS.

| Territory | Stocks at beginning of month | | Production by estates of 100 acres and over | | Production by estates of less than 100 acres | | Imports | | | | Exports | | | | Stocks end of month | | Stocks at ports end of month | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | during the month | | during the year 1930 | | during the month | | during the year 1930 | | | | | |
| | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | Foreign | From Malay States | Foreign | From Malay States | Foreign | Local | Foreign | Local | Dealers | Estates of 100 acres and over | Port Authorities | Private lighters |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| MALAY STATES | | | | | | | | | | | | | | | | | | |
| Federated Malay States ... ... | 10,501 | 16,222 | 13,555 | 13,555 | 11,572 | 11,572 | Nil | Nil | Nil | Nil | 17,272 | 6,599 | 17,272 | 6,599 | 11,753 | 16,226 | | |
| Johore ... ... | 2,343 | 5,616 | 3,964 | 3,964 | 4,580 | 4,580 | Nil | Nil | Nil | Nil | 875 | 7,962 | 875 | 7,962 | 2,172 | 5,494 | | |
| Kedah ... .. | 445 | 2,308 | 2,195 | 2,195 | 1,677 | 1,677 | 1 | Nil | 1 | Nil | 771 | 3,071 | 771 | 3,071 | 537 | 2,247 | * | * |
| Perlis ... ... | | | | | | | Nil | Nil | Nil | Nil | Nil | 26 | Nil | 26 | 21 | 7 | | |
| Kelantan ... . | * | * | * | * | * | * | 3 | Nil | 3 | Nil | 71 | 639 | 71 | 639 | * | * | | |
| Trengganu .. | | | | | | | Nil | Nil | Nil | Nil | Nil | 192 | Nil | 192 | | | | |
| STRAITS SETTLEMENTS | | | | | | | | | | | | | | | | | | |
| Malacca ... ... | 2,246 | 1,986 | 1,479 | 1,479 | | | Nil | 1,100 | Nil | 1,100 | 4,678 | Nil | 4,678 | Nil | 2,482 | 1,904 | Nil | Nil |
| Province Wellesley | 161 | 867 | 611 | 611 | | | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | 150 | 807 | Nil | Nil |
| Dindings ... ... | 42 | 155 | 107 | 107 | 3,332 | 3,332 | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | 47 | 163 | Nil | Nil |
| Penang ... ... | 5,182 | 15 | 13 | 13 | | | 891 | 4,051 | 891 | 4,051 | 6,387 | Nil | 6,387 | Nil | 4,977 | 19 | 913 | 46 |
| Singapore ... . | 27,395 | 379 | 274 | 274 | | | 9,595 | 13,338 | 9,595 | 13,338 | 23,319 | Nil | 23,319 | Nil | 27,875 | 411 | 1,729 | 967 |

ANALYSIS OF COLONY AND FEDERATED MALAY STATES DEALERS' STOCKS AT END OF MONTH, IN DRY TONS.

| Class of rubber (20) | Federated Malay States (21) | Singapore (22) | Penang (23) | Province Wellesley, Dindings and Malacca (24) | Gross total (25) |
|---|---|---|---|---|---|
| Smoked sheet ... ... ... ... | 8,842 | 10,828 | 3,042 | 1,490 | 24,202 |
| Crepe ... ... ... ... | 777 | 14,207 | 1,343 | 676 | 17,003 |
| Unsmoked sheet ... ... ... ... | 842 | 2,840 | 592 | 513 | 6,079 |
| Scrap and lump ... ... ... ... | 1,292 | | | | |
| Total all Grades ... | 11,753 | 27,875 | 4,977 | 2,679 | 47,284 |

*Notes.*—1. Stocks on estates of less than 100 acres are statistically unimportant.

2. The production of estates of less than 100 acres is estimated from the formula: (Column) (6) = (Columns) (12) + (13) + (16) + (17) — (2) — (3) — (4) — (8) — (9).

3. Dealers' Stocks, S.S., are in dry weights quoted by dealers themselves which differ slightly from the estimate of dry weight quoted in the January Dealers' Return already published. The ratio of this reduction on wet rubber in Singapore and Penang, which can be regarded as entirely foreign rubber, is applied to reduce foreign "wet" imports to dry rubber in column 8. This ratio for January, 1930, is 15%.

4. Straits Settlements domestic exports, in the absence of a direct method, may be estimated as the difference between gross imports and gross exports in terms of dry rubber; this for January, 1930, was 5,409 tons.

5. All local exports by Malay States, except 9 tons, were to the Straits Settlements.

* Not ascertained.

SINGAPORE
*February 24, 1930.*

J. GORDON CARRIE
*for Acting Registrar-General of Statistics, S.S. and F.M.S.*

## Summary of Padi Report for the Month of January, 1930.

| State | Locality | Acreage of Padi Land | Acreage planted Current Season | REMARKS. |
|---|---|---|---|---|
| **S. S.** | Pro: Wellesley .. | 39,640 | 34,220 | Age: 3 to 4 months from date of Planting |
| | Penang ... | 4,000 | 2,842 | Scattered areas about 500 Acres not included. Age:—3 to 4½ months from date of planting. Majority harvesting or about to be harvested. |
| | Malacca ... | 35,279 | 29,734 | |
| | TOTAL:—S.S. | 78,919 | 66,796 | |
| **Perak** | North ... | 83,402 | 76,362 | Prospects are good in the more important area. |
| | South ... | * | † 2,930 | Prospects generally poor. |
| | TOTAL:—PERAK | | 79,292 | |
| **N. Sembilan** | Six Districts ... | 37,217 | 31,405 | Prospects good. |
| **Pahang** | West ... | 4,740 | 5,317 | Harvesting : good. |
| | East ... | * | * | |
| **Selangor** | Five Districts ... | 25,212 | 20,632 | Prospects moderately good. Majority already harvested. |

* Not ascertained.

† 5,750 acres dry padi not included.

THE

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# Committees of the Department.

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**The Advisory Committee.**

The Director of Agriculture (Chairman).

The Director, Rubber Research Institute.

The Director of Co-operation.

The Principal, Sultan Idris Training College, representing the Education Department.

Yang Teramat Mulia Raja Abdul Aziz, C.M.G., Raja Muda of Perak.

The Hon'ble Mr. Egmont Hake, M.F.C.

Mr. Choo Kia Peng, C.B.E.

Mr. J. Melville.

Mr. M. J. Kennaway.

Mr. L. P. Jorgensen.

Mr. W. A. Stanton.

Mr. G. S. Reis, B.Sc. (Agric.)

Mr. A. Sharples (Secretary).

**Agricultural Pests Supervising Committee.**

(Under Sec. 4 of Agricultural Pests Enactment 1913).

The Director of Agriculture (Chairman).

The Hon'ble the Legal Adviser.

Mr. F. H. Mustard.

B. J. Eaton, O.B.E.

**The Departmental Technical Committee.**

The Director of Agriculture (Chairman).

The Heads of Divisions.

Mr. F. S. Ward (Secretary).

**Coconut & Oil Palm Research Committee.**

The Director of Agriculture (Chairman).

The Mycologist

The Agriculturist.

The Economic Botanist.

The Plant Physiologist.

The Agricultural Economist.

The Agricultural Chemist.

The Entomologist.

The Chief Agricultural Field Officer.

The Assistant Chemist for Copra Investigations (Secretary).

SCHOOL OF AGRICULTURE, MALAYA.

His Highness the Sultan of Selangor laid the foundation stone at Serdang, Selangor, on March 19th, 1930.

THE

# Malayan Agricultural Journal

APRIL 1930.

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## EDITORIAL.

In the present number of the Malayan Agricultural Journal will be found an abstract of a paper by the Director of Agriculture, Gold Coast, on the subject of the organisation of co-operative marketing of cacao from small holdings, together with an account prepared by Mr. F. G. Spring, attached to the Co-operative Department, Federated Malay States, of the efforts now being made by that Department to organise the co-operative preparation and marketing of rubber from small holdings in Malaya. Taken together, the two articles form an interesting commentary on a problem which is of world-wide importance.

**Co-operation.**

The improvement of peasant agriculture is one of the most difficult questions which administrations have to face and while a great deal can undoubtedly be done in the way of introducing new industries, improved methods of cultivation, new varieties of crops and so on, these efforts are bound, to a large extent, to be discounted if due attention is not paid to the cognate problems of assisting the small-holder to dispose of his produce to the best advantage. Usually small-holders' methods of preparing their produce for the market are defective, while unaided, they are unable to market it to the best advantage owing to the inferior quality of the produce and the unorganised state of the producers. They are thus liable to be exploited by small buyers who purchase their produce in small lots for cash and re-dispose of it to larger buyers who in turn reap their profits on the transaction.

Not infrequently, small growers are forced by circumstances to hypothecate their crops in advance to local shop-keepers in return for goods supplied and are forced to accept whatever prices are offered to them, there usually being some form of arrangement between the buyers of this sort whereby prices are kept at a low level. Such a state of affairs cannot make for improvement and largely vitiates any efforts that may be made to improve production in other directions. An exception to this sometimes occurs in areas where large factories for handling produce exist which are dependent for an appreciable fraction of their output on the produce of small-holders. This is probably most clearly shown in the case of the cane sugar industry in certain countries, notably in Mauritius and Trinidad among British possessions, and in Cuba and Porto Rico among foreign producing countries. In these places, large central factories have been established by private enterprise and efficient

working is dependent on the factories being able to operate somewhere in the region of their full capacity; this can often only be achieved by purchase of peasant-grown products on a large scale. In such circumstances, considerable competition exists for produce and the result is that prices paid for the produce of small-holders frequently attain high levels. In such conditions, the needs of the small-holder, from the market point of view, may be regarded as being fully met. On the other hand, such conditions are, generally speaking, the exception rather than the rule. In Malaya, for example, the average estate rubber factory declines to handle the latex of small producers, because of its defective condition owing to the presence of dirt and other impurities, and also owing to the risk of adulteration and the necessity of keeping greatly increased accounts. It appears to be mainly for this reason that purchasing of small-holders' latex by rubber factories in Malaya has failed to materialise on a scale of any importance. In these circumstances, the move now being made by the Co-operative Department in the direction of the establishment of co-operative rubber factories which will purchase small-holders' latex for cash and dispose of the produce on profit sharing lines appears to be about the only line of attack on the problem that is feasible.

There is no question that advance along these lines necessitates a great deal of spade work, especially in the early stages; but there is also little doubt that provided these efforts are successful and the factories when established are run on sound lines, in due course they will teach the lesson which they are intended to teach viz., that co-operative preparation and marketing, efficiently carried out, means more money to the small-holder. The possible extension of the co-operative principle to other crops is also a matter of interest and there would appear to be considerable scope for the organisation of the marketing of small-holders' produce on co-operative lines in relation to such crops as copra, arecanuts and many other products.

In this connection, it is perhaps interesting to allude to Government produce purchase schemes, which are in reality a form of co-operation and which have successfully worked in a number of tropical countries. Instances of this which may be quoted are the Government cotton purchase scheme in Uganda on which the prosperity of that Protectorate has been very largely built; the smaller similar cotton purchase schemes which have been worked for many years in a number of the West Indian Islands; the tobacco and cotton purchase schemes which have operated for a number of years in Ceylon; but a distinction must, however, be drawn between this type of effort—in which the whole of the operations are financed and controlled by the Government—and the truly co-operative schemes in which the financial arrangements are provided in the first instance by the small-holders themselves, who raise a nucleus of the capital required among their membership and pledge their credit for the balance. Undoubtedly this latter procedure involves considerably greater difficulties in the early stages, but it seems probable that by developing a spirit of self-reliance and willingness to combine among the small-holders themselves, the additional effort required and the slowing up of progress in the early stages which are

inevitable concomittants of its adoption, may in the long run, be well worth the extra trouble involved.

The future of these produce purchase schemes in Malaya and on the Gold Coast are full of interest and if in due course they bear fruit, then it may be reasonably expected that they should pave the way for the partial solution of a difficult problem in both countries.

In conclusion, a word may be said as to the relationships existing between the official organisations for co-operation and agriculture. It is now becoming generally recognised that co-operative and economic work form the logical extension of the operations of a Department of Agriculture. The two branches are mutually complimentary and it has been truly said that the work of the co-operative organisation begins where that of the agricultural organisation leaves off. It is the work of a Department of Agriculture to endeavour to point out the means whereby agricultural methods and processes in crop production can be improved. In the commercial application of these results and particularly in the region of financing and marketing the produce lies the rôle of the co-operative organisation. In some countries, e.g., Ceylon and the Gold Coast, the Co-operative organisation forms a wing of the agricultural organisation. In other countries, e.g., Malaya and India, separate organisations are provided for each service. Whichever form of organisation is adopted, it is, however, essential that close liaison should be maintained between the two branches, if really effective work is to be performed.

**Labuan.**

Interest attaches to the article on Agriculture in Labuan by Mr. Sands, which appears in the present number of The Malayan Agricultural Journal. At the request of the Resident, Mr. Sands paid a visit to this dependency in July, 1929, with a view to reporting on agricultural conditions, and the present article has been prepared on the basis of information collected on that occasion. Geographically, Malaya and its dependencies are an entity and consequently, as the prosperity of Malaya as a whole is largely dependent on agriculture, interest attaches to the agricultural conditions obtaining in any part thereof.

Probably the fact which strikes the new-comer to Malaya most forcibly is the extraordinary degree of divergence which prevails in the standard of development attained in different places. In the Straits Settlements and those portions of the Federated and Unfederated Malay States lying on the Western side of the central mountain range, development has been pushed to a remarkable pitch in a comparatively short space of time. On the Eastern side of the range and in the outlying possession, development has been much less rapid. It seems reasonable to suppose that within the next fifty years, considerable further developments are likely to take place in these areas. As a preliminary to development, systematic surveys of the resources of the undeveloped areas is an obvious necessity and from time to time as an opportunity permits, it is hoped to publish in this Journal accounts of the agricultural conditions in these regions of Malaya.

On page 184, an important article on a disease of oil palms appears, written by Mr. Sharples, Government Mycologist and Mr. L. P. Jorgensen, the well-known authority on oil palm planting. The attention of the Department was directed to the serious nature of the disease by Mr. Jorgensen, and he kindly consented to put on record his field information, which is incorporated in the article. This is essentially a preliminary report, written to call attention to the existence of a serious affection against which preventive measures may have to be undertaken in the early years when leaf pruning is first started. At the present time, the evidence strongly favours the view that, in the great majority of cases, the fungus gains an entry into leaf-bases through the tissues exposed in pruning, passes down the leaf-base into the stem and spreads rapidly in a horizontal direction. There is some evidence to indicate that a direct attack on the stem tissues can be made without prior growth through the leaf bases, owing to the spores of the fungus lodging in the leaf axils, between the leaf-bases and the stem; the conditions for germination of the spores and growth of the fungus could not be otherwise than favourable in such a position and it may be anticipated that such direct attack on the stem tissues will be proved by further work.

**Stem Rot of Oil Palms.**

It is of interest to add that the fungi so far found in Malaya associated with this Stem-Rot of oil palms are

(a) *Fomes lamaoensis*, which to rubber planters is well known as the cause of Brown Root disease.

(b) *Ganoderma lucidum*—(*Fomes lucidus*) which has been found associated with a stem-rot of oil palms in West Africa. The suggestive character of this observation is very obvious and it may be that it will ultimately be found to constitute a relationship of considerable importance. On the other hand, the point must not be overlooked that while close association of a definite fungus with definite symptoms is a useful guide, either of the two above-mentioned fungi may be purely secondary and the true cause prove to be quite a different organism.

# AGRICULTURE IN LABUAN.

BY

W. N. SANDS,

*Acting Economic Botanist.*

The small island of Labuan lies off the West Coast of British North Borneo. Its area is about 30 square miles. At its nearest point it is only six miles distant from the large island. There are a number of small islands included in the Settlement. The more important of these, from an agricultural standpoint, are Kuraman near to the southern end of the island and Da'at off the south-east coast. Labuan possesses, in Victoria Harbour, an excellent deep-water port with good shipping facilities. A large transhipment trade is carried on with Brunei, British North Borneo and Sarawak. Local produce and livestock shipped by steamer reach the markets of Miri in Sarawak in 10 hours and in Singapore in 3½ to 4 days.

The country is undulating with low hills, the highest of which reaches a height of 300 feet only. The soils are derived from sandstone and shale: they are often shallow, with the subsoil hard and impervious and taken as a whole, are not very fertile. There are no forests, but large areas are covered with secondary bushy growths of mixed species of plants with the 'simpak' (*Wormia Burbidgei*), 'puak' (*Fagraea crassipes*) and 'sendudok' (*Melastoma polyanthum*) predominating, or with the 'lallang' grass (*Imperata arundinacea*). Bush and grass fires are common in the drier months of the year.

The rainfall is heavy and fairly well distributed throughout the year. The average annual precipitation for the past seventeen years was 137.71 inches.

The driest months are February and March with averages of 6.66 and 5.80 inches respectively. The month of April is usually a wet one with 14.28 inches, whilst for the period September to December, the monthly rainfall averages over 15 inches per month.

The population in 1928 was estimated at 5,904 persons, consisting mainly of Kedayan Malays, who are very poor cultivators, and Chinese. Among the latter are Hokkien and Kheh settlers who are good land-workers. Should the coal-mines of the island be successfully re-opened there would immediately be a considerable increase in population.

A good system of metalled and earth roads and bridlepaths is being formed; this will enable produce and stock to be transported quickly and economically to Victoria Harbour. The beneficial effects of these works of public utility are already evident in that there is now a demand, particularly by Chinese settlers, for land near to the roads for coconuts, rubber, vegetables and fruit.

The area under cultivation is estimated at 10,250 acres, made up approximately of coconuts 3,500 acres, rubber 2,750 acres, padi 1,900 acres, and other crops 2,100 acres.

As will be shown later, the acreages given under coconuts and rubber are not strictly comparable with similar areas of plantations and small holdings

elsewhere for most of them are overgrown with secondary growth and 'lallang' grass; many are very deficient in number of trees and carry trees badly damaged in various ways.

In 1928 the chief exports of local produce and livestock were:—

| | | | | |
|---|---|---|---|---|
| Rubber | ... | 69 tons | valued at | $46,400 |
| Copra | ... | 196 ,, | ,, | 36,272 |
| Fresh vegetables | ... | 91 ,, | ,, | 10,764 |
| Fruit | ... | 52 ,, | ,, | 10,098 |
| Cattle and Pigs | ... | 200 head | ,, | 8,256 |
| Padi | ... | 60 tons | ,, | 4,821 |

Although 60 tons of padi were exported, chiefly to Brunei, the imports of polished rice far outweighed that quantity. The fresh vegetables, fruit and livestock were exported mainly to Miri in Sarawak where there is an extensive oil-field employing a large number of Europeans, Chinese and other people.

Leases of Crown lands are disposed of by public auction. It is the practice now to issue leases for a term of 30 years, but most of the lands are held under 99 years leases. The minimum quit rent chargd is one dollar per acre.

With the exception of two estates with a total planted area of 1,300 acres of coconuts and 180 acres of rubber, the cultivated area consists of small holdings. The labour supply available on the estates is mainly Kedayan. The people work on a share system, but they are not satisfactory workers because they do not use agricultural implements but rely almost entirely on a long sword-like knife, (parang) for most operations. The Kedayan small-holdings are, as a rule, in very poor order, whereas those of the Chinese are far more carefully cultivated.

In all parts of Labuan, wild pigs do an immense amount of damage to food crops, whilst monkeys and squirrels often cause extensive damage to coconuts and fruit. Many common insect pests of similar crops in Malaya are present.

The coconut palm is more extensively grown than any other plant. The acreage under it is estimated at 3,500 acres, giving a yield, based on exports* of 125½ lbs. of copra per acre. At to-day's value (Aug: 1929) in Singapore this produce is worth $8.50 only, less commission, insurance and freight charges. All of the copra is sun-dried. On low-lying land near the sea, in small valleys and on islets off the coast, the palms yield fairly well. No attention is given to the cultivation of the crop or drainage of the land. The healthiest coconuts grown on any considerable scale were seen on the islets of Kuraman and Da'at; here cattle are allowed to graze under the palms on pasturage consisting for the most part of the hardy 'love-grass' (*Chrysopogon aciculatus*). On these islets, fairly close attention is given to the control of insect pests, more particularly the rhinoceros beetle (*Oryctes rhinoceros*) and the red stripe weevil (*Rhynchophorus Schach*).

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* Local consumption would not be large.

On the main island, a far different state of affairs exists. Whilst it is possible to note flourishing palms, there is a very large number of small-holdings where the palms are badly neglected; where many are dead or dying and others damaged by insect pests.

The general practice in planting up an area with coconuts is to clear and burn off the trees, bush and grass and then plant up the land with hill-padi, tapioca, bananas or pineapples, amongst which the young coconuts are planted. By the time the catch-crops of the earlier years are taken off, the land, never particularly rich, is much reduced in fertility; not alone by the exhaustive effects of the temporary crops, but also as a result of the heavy soil erosion which takes place, more particularly on the sloping lands, in the absence of head, contour or other drains, silt pits, or cover crops.

When no further planting is possible and in the absence of stock, the land under the palms is quickly covered with bushes and 'lallang' grass, and this may not be cut back from the palms. Wild pigs always take a heavy toll of the young palms; in one district alone, 200 acres had recently been destroyed by them.

Then again, a most harmful system is frequently adopted on small neglected holdings, which consists of heaping bush, grass and leaves at the bases of mature trees and setting fire to them. It is believed by the peasantry that the burning of the coconut trunks induces fruit production. Whether there is—or is not—a temporary stimulation of fruiting, the ultimate result is disastrous, as can be seen in the large number or badly damaged trunks in various stages of decay and dead and dying palms. The damage done by the rhinoceros beetle is extensive, and this pest will continue to give trouble unless the usual measures for its control can be enforced.

Generally speaking, the Para rubber tree does not develop well under local conditions. Unsuitable soil and poor methods of cultivation are, without doubt, the reason for this. The area planted amounts to about 2,750 acres. There are no plantations exceeding 100 acres, in fact, there is only one approaching that area. Most of the rubber, therefore, is on the lands of the peasantry. There are about 200 small rubber holdings. The best areas—and these are poor from a Malayan standpoint—are chiefly those belonging to Chinese settlers. Even these are mostly in secondary growth or 'lallang' grass, with strips of land cleared in the lines of the trees. The narrow cleared areas nearly always extend in straight lines up and down the slope of the land to form channels for soil-wash during the heavy rains to which the island is subjected.

In the older plantings, the trees were almost invariably damaged by very bad tapping in the past. Somewhat better tapping is now practised in younger areas, but often the trees are tapped while still too young. As most of the tapping is done on a share system, the tappers endeavour to obtain as much latex as possible, regardless of damage to the bark, consequently the bark renewal is very poor.

A certain amount of new planting is in progress, chiefly by Chinese owners, but, as with coconuts, there is a notable absence of modern methods of cultivation.

Owing to the neglected state of much of the rubber and the high number of untappable and undersized trees, it is difficult to assess yields, but it is highly probable that, over considerable areas, a computed yield of 56 lbs. per acre, per annum, may not be subject to a very wide error.

There are 1,900 acres under padi cultivation. The 'sawah' or flooded lands appear to possess suitable soil for this crop: they are not irrigated so that all the padi is dependent on rain. The rainfall is ample for the requirements of the crop which is cultivated in the rainy, or north-east monsoon season. Little attention is given to drainage. Sea-water occasionally enters the lower portion of the largest padi area rendering the soil unsuitable for cultivation.

Preparation of nurseries and lands is not commenced before the end of July or the beginning of August. The lands are prepared for planting by driving water-buffaloes round and round in the 'sawah'*. The buffaloes trample down the weeds and grass and puddle the soil. No plough or other implement is used so that the work is very slow. The best lands are said to yield 300 to 350 gantangs of padi per acre. The varieties mostly grown are 6—7 months padi of the Siam and Radin types. These varieties were obtained from Malaya by a former Resident in 1919. Their place of origin in the Peninsula has not yet been ascertained, but was probably Malacca. The names given to the varieties are Padi Siam, Padi Bajar and Padi Acheh. The former is the usual long-grained Siam type, whilst the latter resemble the shorter grained Radin varieties. In view of the fact that imported varieties have yielded well, it is likely that certain selected Krian strains would give even better returns. A small supply of pedigree seed of Radin 2 and Radin 4 has since been sent to the Resident of Labuan so that it could be sown this season with the local varieties and compared with them.

All the padi is stored in the ear in small rat-proof padi houses or 'durong'. These are well-built leaf roofed rooms placed on stout posts about 8 feet high. Each post has a broad circular protective shield of wood or iron attached to it about 7 feet from the ground to prevent rats and mice reaching the grain. Samples of padi were examined which had been stored for some months and found to be in excellent condition.

More than sufficient padi is usually produced annually for the requirements of the Kedayans themselves. The surplus is exported to Brunei and elsewhere. The Chinese population uses, for the most part, polished imported rice.

In the Rancha Rancha district and along Coal Point and MacArthur roads, where land and water transport is easy and rapid, there are numerous Hokkien and Kheh settlers growing vegetables for local consumption and export to Miri in Sarawak. The vegetables noted were 'sayur puteh,' 'bawang puteh' (eschallots), cucumber, 'trong', chillies, 'peria' or bitter cucumber; pole and bush beans, sweet potatoes, yams and celery.

The gardens are usually situated in the valleys where there is a permanent

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* The system known to the Malays as 'Lanyak' in parts of Pahang where the land is very lowlying and the mud deep.

supply of water. Lands that have been abandoned to secondary growth and 'lallang' grass are quickly brought into a good state of tilth by deep cultivation, by the planting of cover crops of sweet potatoes and the application of animal and vegetable manure. It is of much interest to note how rapidly poor soil is made fertile by the intensive methods of cultivation practised by these industrious people and the excellent crops they raise from it.

The success of the trade in fresh vegetables depends, at present, on quick weekly steamer communication with the port of Miri—Singapore being too far distant. The exports are steadily increasing with the development of the oil-field in Miri. In 1924, 56 tons of vegetables were shipped, whereas in 1928, the quantity sent away amounted to 91 tons. The home demand will increase enormously if the local coal-mines are re-opened.

In former years there must have been quite a large amount of fruit grown on the island, judged by the number of old fruit trees of various kinds to be seen in different districts, but now for the greater part, sadly neglected. The decline of fruit growing is said to have been due to lack of suitable markets, but there may have been other reasons such as, for example, the attacks of insect pests and diseases.

Important fruit trees and plants which thrive well, when properly cared for, are citrus fruits such as pomeloes; free-skinned oranges of the mandarin and tangerine types, and limes, mangoes, pineapples, mangosteens and bananas.

Citrus trees grow to a large size and produce good crops of fruit when cultivated and manured. Unfortunately, with the possible exception of pomeloes, a large percentage of the fruit is damaged by the larvae of small moths known in the Philippines as citrus borers (*Prays citri*, Mill, and *Prays endocarpa*, May). The eggs of these pests are laid in the young fruit, and the larvae which develop from them feed on the pulp just below the rind. The mature insect emerges through a small hole in the rind usually before the fruit is fully ripe. As the fruit ripens, decay sets in below the place where the insect left it, and the fruit is rendered valueless for market purposes. It was estimated that quite 40% of the crops was damaged. Spraying the young fruit with an oil emulsion is said to keep the pests under control.

With few exceptions, the trees are heavily parasitized by species of mistletoe belonging to the genera *Loranthus* and *Elytranthe*. No attempts appear to be made to clear off these growths by careful pruning, with the result that the trees are slowly killed.

Many fine mango trees of common and Manila kinds were seen, but a large proportion of the fruit was attacked by a small beetle (*Cryptorhynchus mangiferae*, E.) In common with the citrus trees, the best sorts of mango were usually heavily infested with mistletoes and were badly damaged.

The large Sarawak variety of pineapples is the kind most favoured for inter-cropping with coconuts and rubber. Many exceptionally fine fruits were seen, more particularly on Pulau Da'at. A fairly large percentage was damaged by a soft rot which was not apparent until the fruit was cut open. It

is doubtful, on account of the presence of this disease, whether the variety would be suitable for export on any considerable scale.

The ordinary mangosteen grows well, and some excellent trees were seen. If the main crop of fruit is earlier or later than that in the Straits Settlements, there should be a satisfactory market for it in Singapore and elsewhere.

Generally speaking, the soils are not sufficiently fertile to carry good crops of bananas, but some good sized bunches of several varieties were noted in various places.

The sago-palm (*Metroxylon sagus*, Rothb.) grows well in low-lying places with an abundance of fresh water. There is a small local production of sago flour for export. The sago is obtained from stems of 8 to 10 years old. The excess of exports over imports for the past five years was 378 tons, or an average of 75 tons per annum. The export value was about $92 per ton. There does not appear to be any considerable area of land, other than that already wisely reserved for padi, for any extension of planting.

Tapioca (*Manihot utilissima*, Pohl.) is a favourite catch-crop in young coconut and rubber areas, and is also grown in gardens. The roots are prepared in various ways for human consumption and are also used by the Chinese for feeding domestic pigs. The crop is a very useful one for the purposes indicated, particularly as it forms the chief food used for fattening pigs for export. The yield of roots from the local varieties appeared to be fairly satisfactory.

The dried betel or areca-nut, either whole or split, finds a ready market in Singapore and there appears to be no reason, judging from the palms seen growing in Labuan, why with systematic planting and cultivation, the Island should not produce this nut for export. The palm is easily grown and the produce has only to be shelled and sun-dried in preparation for shipment.

Water-buffaloes and cattle are reared, the latter mainly mixtures of ordinary Indian kinds. The pigs kept belong to breeds usually favoured by the Chinese in Malaya. There is a small export trade, mainly with Miri in Sarawak, in these animals for slaughtering purposes. In 1928 there were exported 103 head of cattle and 97 head of pigs valued at $4,690 and $3,566, respectively.

There is no import duty in Miri on cattle and buffaloes for slaughter, but on pigs there is a heavy duty of $10/- per head which is equal to 25% or more of the value of the animal. On poultry—such as geese, ducks, and fowls—the duty is 10% *ad valorem*. In respect of pigs and poultry, it is said that the Sarawak import duties have an adverse effect on the local export trade with the result that the business is not likely to extend.

The foregoing account shows that agriculture generally in Labuan is in a very backward state due to a combination of adverse conditions. The principal causes which militate against agricultural progress in Labuan are; poor soil, the backward state of agricultural knowledge possessed by the Kedayans, the lack of expert guidance, and possibly also of capital to carry out improvements necessary for increasing their crops and to protect their property from the ravages of wild pigs and other pests.

# A SERIOUS STEM-ROT OF OIL PALMS
## (Elæis Guineensis).*

BY

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and

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During the last two years a stem disease of mature Oil Palms has become more and more prominent. This disease is considered to be so serious (in certain stands as much as 10% of the palms have been found to be attacked) that although the information gained up to date is rather scanty, it is considered necessary to warn oil palm planters of the existence of the disease by the issue of this preliminary report.

This stem disease has been reported from three different estates in Malaya and is usually found in palms 8—10 years old, though a record of the disease on a palm 5 years old has been obtained recently. In the majority of cases the rot appears to start in the short length of leaf-base left adhering to the trunk when the leaves are cut off for the purpose of pruning or of gathering the fruit-bunches. The leaf-bases are rotted and the fungus then penetrates into the trunk of the palm, causing a rotting of the stem tissues; this rot in the stem appears to progress rapidly in a transverse direction, so that a transverse section shows the whole of the stem tissues disintegrated, while the rot has progressed vertically some two to three feet only. The lower parts of the stem tissue from ground level up to 3-5 feet are usually quite sound, so the question of root trouble has not to be considered. The attacked leaf-bases and fibrous tissues of the trunk have a reddish-brown colour and in advanced cases the diseased tissues become spongy and wet i.e. Wet-Rot.

At this point it may be of interest to consider reports of diseases on oil palms from other countries.

There are various inconclusive records of African oil palm diseases from West Africa. A species of *Ganoderma* has been associated with a rot of the trunk; this species is closely related to a fungus common in Malaya e.g. *Ganoderma lucidum,* but the West African fungus is said to agree best with *G. tumidum* Bres. The various records from West Africa indicate that a wide-spread trunk-rot of oil palms is caused by a species of *Ganoderma.* There is some doubt as to whether one or more species of *Ganoderma* is concerned.

* The following article is a preliminary report on this important subject.

The names *G. tumidum, G. lucidum,* and *G. applanatum* have been applied, but *a priori* it would seem probable that only one species is parasitic.

A recent report from Sumatra records the finding of *Rigidoporus microporus,* Van Overeem, = *Fomes Lignosus* Klotzsch. on oil palms. The fungus attacks the soft tissue in the middle of the trunk, producing a "Wet-Rot." The thin roots are not attacked, however, and this is probably the reason why the affected palms languish for a long time before dying. A case of *Fomes lignosus* Klotzsch. on oil palms has been found in Malaya during the last year, but though there was a profuse development of frucifications on the dead tissues of the old leaf bases at the base of the stem there was no evidence to show that the fungus penetrated into the stem tissue.

Thus, the records from West Africa indicate that a very similar stem disease has been known on oil palms in that country for some years. Species of *Ganoderma* are known in Malaya by their less exact designation of *Fomes* sp. but for the purpose of this report we can consider that *Ganoderma* = *Fomes.*

A common fungus, *Fomes lamaoensis* (Murr), considered to be the cause of the well-known Brown Root disease of rubber trees, has been found closely associated with this disease in Malaya. Another fungus, i.e. *Fomes applanatus* (Pers), has been found to be associated with a diseased condition of oil palms 3-5 years old, but up-to-date, the symptoms have not been clear in these cases owing to white ant attacks at the roots. White ants are commonly found on the older diseased trees, with which *F. lamaoensis* has been found associated and it was first suggested that the fungus attack was of a secondary character, made possible by the damage previously done to the trunk of the palms by white ants. However, cases have since been found which rule out this suggestion; palms have been examined which show no sign of white ant attack, but which show the whole of the stem tissues rotted for a length of three feet, the lower limit of the disease being 2-3 feet above ground level.

In the majority of cases, the attack can be discovered by a close examination of the adhering leaf-bases which show signs of decay and on being pulled off, a characteristic red-brown colour of the diseased stem tissues can be seen. In some cases, however, no signs of decay can be seen on the outside leaf bases and no indication of the disease is observed until the palm is blown over by a heavy wind. These palms frequently retain their green leaves and generally healthy appearance, even when only a small portion of the trunk remains unaffected by the fungus. Such cases indicate the possibility of the stem tissues of the oil palm being attacked direct, without any antecedent growth of the fungus *via* the leaf-bases.

Isolations of the prominent fungi have been made and pure cultures of *F. lamaoensis, F. applanatus* and an unknown fungus have been obtained. Inoculation experiments will be commenced as soon as possible, but these must be deferred until further work on control measures has been carried out.

## Preventive and Control Measures.

### (*a*) Preventive Measures.

When first reported, a large number of trees were found diseased and preventive measures designed to save as many as possible of the more slightly affected trees were recommended as follows:—

Where the leaf-bases are found to be attacked, they are cut flush with the trunk of the palm, exposing the stem tissue. The cutting is continued upwards and downwards until six inches of healthy stem tissue beyond the upper and lower limits of diseased tissue is exposed. The stem tissues exposed in this manner are freely painted with a 20% solution of Agrisol. A day or two later the painted tissues are covered with a coating of coal-tar.

It has been found that the coat of tar cracks in the course of time, and fissures $\frac{1}{8}''$ wide appear in the treated stem tissue. This has been found to apply in many cases in experimental treatments with other disinfectants and experiments are in hand to find some suitable painting material which does not crack up in the manner described. It has been suggested that a mixture of asphalt and a non-drying oil may provide a better protective coating which would not crack so easily as the coal-tar covering.

The above treatment, while expensive, has been found successfully to stay the attacks on slightly affected palms, i.e. where the disease has not progressed so far as to attack the stem tissues to any great extent. It is obvious, however, that nothing can be done to the palms which have been attacked directly and which show no definite disease symptoms before being blown over. The only procedure in these cases is to cut up the trunks of the fallen palms and burn *in situ* as quickly as possible.

### (*b*) Control Measures.

The foregoing indicates the obvious primary necessity of the protection of the cut ends of the leaf-bases when considering control measures. If, in future, the disease is definitely proved to be as serious as it seems to be at present, the protection of cut leaf-bases will probably become a routine procedure on oil palm plantations. In view of this, it is very necessary to consider not only the question of protective value, but also the question of costs more closely than is usually the case.

Experiments with various paints and disinfectant fluids are being carried out and while no definite results have eventuated on which recommendations can be made, the writers have reason to hope that a method of protection will be found which will not prove too costly.

With respect to the spread of the disease, well developed fructifications of *F. lamaoensis* have been found in the bottom of heaps of prunings 3-4 months old. The spores produced by these fructifications will be blown about the estate and other trees will naturally be infected. It is, therefore, most

important that on estates where the disease has obtained a good hold, an effort should be made to get rid of all prunings as quickly as possible. It is obvious too, that the material resulting from the felling of diseased trees should be destroyed as early as possible. Destruction by fire is by far the best method, but oil palm estates with peaty soil should beware of the danger of peat fires. If there is danger of peat fires, or if rain prevents firing, pits should be dug in which the debris can be placed, covered with lime, and then covered over with soil.

The fructifications of *F. Lamaoensis* are of the usual bracket shape, typical of other *Fomes* sp., dark-brown or purple-brown in colour. They are very hard and when cut in sections, show a pale-brown or dark-brown context.

## Added Note.

Fructifications recently gathered and found growing from a diseased stem which had been previously treated have been identified by Mr. E. J. H. Corner, Assistant Director, Botanic Gardens, Singapore, as a sessile, hardly laccate form of *Ganoderma lucidum* (Leyss) Karst. This fungus is mentioned above in connection with the Stem-Rot of oil palms in West Africa. The fungus has been isolated in pure culture, and inoculations will be carried out as quickly as possible to try to establish the exact cause of the disease.

# THE MALAYAN PINEAPPLE INDUSTRY.

BY

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*Agricultural Economist.*

The consumption of canned fruits has increased enormously during the last decade, especially in Europe and America, owing in part to the wide publicity summed up in the slogan "eat more fruit," and to the greater care in the grading and packing of fruit. Of late, the publicity campaign of the Empire Marketing Board in appealing to the public to eat "Empire Grown Produce," coupled with their excellent displays and demonstrations at the large exhibitions in the United Kingdom, have had the effect of still further stimulating the trade. Malaya has benefitted in this publicity by widening her markets for canned pineapples. Although the price of canned pineapples has been somewhat unsatisfactory of late, it is felt that a reaction will set in due to the increased demand and the improvements which are undoubtedly being effected in the local canning industry.

**Exports of Canned Pineapples from Malaya.**

| Year | Tons | Value $ | Value per ton $ |
|---|---|---|---|
| 1919 | 8,228 | 3,286,001 | 412 |
| 1920 | 10,346 | 7,178,016 | 694 |
| 1921 | 21,299 | 6.210,383 | 291 |
| 1922 | 22,843 | 6,697,098 | 293 |
| 1923 | 28,605 | 5,874,858 | 205 |
| 1924 | 39,204 | 8,873,977 | 226 |
| 1925 | 43,207 | 8,236,824 | 191 |
| 1926 | 40,634 | 7,669,784 | 188 |
| 1927 | 40,134 | 8,296,656 | 206 |
| 1928 | 46,400 | 8,421,230 | 181 |
| 1929 | 58,692 | 9,233,732 | 157 |

Previously to 1923, the official figures of exports of canned pineapples were stated as number of cases. For the sake of comparison they are stated above in tons, at the rate of 72 lbs. per case.

British Malaya is thus the second largest producer of canned pineapples, Hawaii taking the premier position. Hitherto, Hawaii has hardly entered into competition with the Malayan product, as that country catered largely for another market and with a different grade of product. The aim of the Hawaiian canner was to market a product of first class quality. This of necessity could only be achieved by rigid selection and a large amount of waste, resulting, as might be expected, in a comparatively expensive article. Malaya, on the other hand, set out to place a cheap canned fruit on the market. This was rendered possible by the fact that pineapples were looked upon as a catch crop on Chinese rubber plantations and by the incidence of cheap labour and cheap factories of a temporary nature, situated in close proximity to the growing crop, thus reducing to a minimum all freight charges.

For the above reasons, it was possible for Malaya to market a product which, if not perfect as far as grade was concerned, was a canned fruit of good quality, delicious in flavour, and the cheapest canned fruit on the market. Thus, it automatically became the poor man's dish and found a ready market in the United Kingdom.

The above remarks regarding grading must not be taken too literally. A considerable amount of grading was necessary—and is inseparable with pineapple canning. It is estimated that only one-third of the total weight of pineapple arriving in the factory leaves it as the finished canned product.

During the past two years, efforts have been made to improve the quality of Malayan pineapples, if possible without increasing the cost of production. That such efforts have been successful is shewn by the following abstract from an official report of the Malayan pineapples exhibit at the Imperial Fruit Show, Birmingham, 1929.

> "One very gratifying feature of the Show was that numerous retailers, while mentioning that in years gone by Singapore pineapple had enjoyed none too good a reputation as to grading and quality went on to state that the improvement recently made in these respects has been most marked; and there were some who offered the opinion that the best brands of Malayan fruit—though not all, of course—can now compare on level terms with the product of Hawaii".

The United Kingdom market is at present held by the Malayan product, and it is proposed not only to hold this market by maintaining the quality, but to extend it to other countries, and to other classes of consumers. It is estimated that 86% of the canned pineapples consumed in the United Kingdom are the produce of the Overseas Empire, while Malaya's share of this is over 80%.

Two features of Malaya's trade in canned pineapples may be noted in this place—that of situation of the factories and policy regarding affixing labels.

At one time, practically all the pineapples were grown on the Island of Singapore, or were grown on the neighbouring mainland of the State of Johore and the fresh fruit despatched to the factories in Singapore for canning pur-

poses. Singapore was also, of course, the port of shipment to Europe; consequently the produce was known as the "Singapore" canned pineapple. Of recent years, however, owing to the growth of the trade, the absence of suitable and sufficient areas on the Island, and to the development of rubber cultivation on the virgin soils of Johore, the production of pineapples has become a more distinctive feature of Johore agriculture than that of Singapore, until at the present time there are more pineapple canning factories in Johore than in Singapore. Further, a factory was also opened in the State of Selangor. While practically all shipments were effected through Singapore, it was no longer correct to presume that the goods were the product of Singapore, so that the term "Malayan Pineapples" has gradually found favour as being a more accurate description. Singapore has not entirely lost her personal interest either as producer or canner. There is still a considerable area under the crop and several factories on the Island.

The question of labelling the tins is one of great importance in the policy of marketing Malayan pineapples. It was previously the custom for the local product to be exported without label, and for the labelling to be done in the United Kingdom. One has little information as to the ultimate labelling of such goods, but if the Malayan product is to be an important factor in the market it is desirable that no secret should be made of the country of origin. It is possible that the country of origin was in some cases suppressed owing to the not altogether flattering opinion of the Singapore product which was held in some quarters. During the past three or four years, the policy regarding this subject has entirely changed. It is now customary for the labels to be despatched from the United Kingdom and affixed to the tins in this country. In almost every instance such labels state that the contents are the produce of Malaya or of Singapore. There are probably two reasons for this change of front; it is cheaper to affix labels in this country than in the United Kingdom, where high wages are the rule; and secondly, by admitting the country of origin, the distributor is taking advantage of the very valuable publicity campaign at Exhibitions, at which Malayan pineapples are advertised and their preparation for the table demonstrated.

The future of the industry is of some concern to British Malaya. The exports have grown enormously, and the market is extending. On the other hand, it must be realised that practically the whole area under the crop is interplanted with rubber, which will entirely replace the pineapples in the course of about six years. The area under the crop in Malaya is between 40,000—50,000 acres, of which probably less than 5,000 acres is of pineapples treated as the main crop. It follows, therefore, that the maintenance of the canning industry depends upon new areas being opened up and planted with pineapples to replace the old areas as they drop out. This replanting depends, at present, almost entirely on the planting up of new areas with rubber, in which pineapples is to be treated as a catch crop. It is reasonable to anticipate that the programme of planting up new areas with rubber will proceed at a less rapid rate than

hitherto, on account of the present slump in rubber. Does this spell the curtailment of the cultivation of pineapples and the gradual loss of markets on account of shortage of supplies? Unless there is a change of policy regarding the planting of pineapples, it is possible that Malaya will lose her pre-eminence in this trade.

The cultivation of pineapples as a sole crop is quite possible provided suitable provision for fallowing areas and a programme of manuring is given consideration. The great advantage of this system would be that the factory and the machinery might be established of a more permanent nature than those general at the present time. This would react favourably on the cost of production and the maintenance of the quality of the finished product.

In order that those interested in this aspect of the subject may have at hand the outlines of the experience of pineapple cultivation in this country and elsewhere, it is proposed in the next number of this Journal to state the present methods of cultivation and canning of pineapples in Malaya, contrasted with methods obtaining in Hawaii and South Africa.

# CO-OPERATIVE RUBBER SOCIETIES AMONGST SMALL-HOLDERS.

BY

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Co-operative marketing, or in other words, the organised production and sale of all crops, is a matter of world-wide importance at the present time; in particular, the co-operative marketing of rubber on somewhat similar lines is a vital economic question of to-day for Malaya and the British Empire. When the co-operative manufacture and sale of rubber is firmly established amongst small-holders, it is hoped that it will assist in any proposals for the co-ordination of the industry as a whole. The immediate objective, however, is to improve the methods of cultivation and the grade of rubber manufactured in the native holdings.

Mr. C. F. Strickland in his report on Co-operation in Malaya* states:—

> "There is no reason to doubt that the factories can confer a direct economic benefit on the small producer, can establish themselves on a sound footing and pay off whatever debt it is necessary to incur for building expenses, if the producers will remain loyal to them for a period of years. The question is whether the economic inducement will be sufficient to hold the loyalty of a producing class, in whose lives economic values do not play so large a part as in other countries. The factories will offer this advantage over the alternative scheme of selling latex jointly to a big Estate, that, while the latter method provides only a safe market, the former encourages the Malays to build up a local institution which they may regard as their own and of which they may feel proud. If this idea appeals to them, I think that the rubber societies may flourish; they may expand with reasonable rapidity, which will depend on the careful guidance of the first two or three societies. I advise that no undue haste be used in their formation."

Co-operative rubber societies will provide members with more time for development of other sources of income such as fruit and vegetable cultivation, short duration crops, poultry farming, etc. They will, in addition, prove centres for lectures, demonstrations and serve generally as channels for the dissemination of information.

The acreage under rubber on holdings of less than 100 acres in the Federated Malay States as recorded in statistics relating to rubber compiled by the Deputy Supervisor of Rubber, amounted to 534,937 acres in the year 1928, while the total acreage under rubber at that time amounted to 1,433,056 acres.

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* Federal Council Paper No. 26 of 1919, paragraph 4.

It will be seen from the above figures that small holdings of less than 100 acres represent approximately one-third of the total acreage of rubber in the Federated Malay States.

Before it was possible to determine the suitability of any particular area as a centre for a co-operative rubber factory, it was essential to make a detailed economic survey of all the holdings and their ownership, state of cultivation, methods of marketing, mortgage indebtedness, etc. and an appreciation of the problems likely to be encountered.

The preparation of draft bye-laws required special care in the absence of any local experience as a guide or precedent. Draft bye-laws were ultimately prepared and a special conference was held to consider their suitability and where necessary make required alterations. Senior officers of the Co-operative Societies Department attended the conference and had the benefit of hearing the views of Mr. Strickland, I.C.S. The bye-laws were published in English and Malay, the former being distributed to all senior Government officers throughout the Peninsula and the latter amongst Malays where propaganda was being conducted for the formation of societies. The Malay translation was published in *Warta Perusahaan Tanah*, the quarterly publication in Malay issued by the Department of Agriculture, S.S. & F.M.S.

To secure interest in the scheme amongst the small-holders in the early stages of devlopment and to obtain their confidence, it was essential to devote a great deal of time to each particular centre. In order to expedite matters, two Malay Co-operative Officers were detailed to secure the closest contact with the people concerned.

The Organisation Officers at headquarters took charge of five rural credit societies in areas in which rubber organisation work was in progress. This is desirable as there is considerable co-relation between the two types of societies.

The following plan of organisation was adopted and will be adhered to subject to the dictates of future experience. Rural credit societies were used as agencies for spreading information as to better methods of cultivation, collection and preparation of rubber and acted as a stepping stone for the formation of co-operative rubber societies. The assistance of local headmen was also enlisted. When sufficient interest had been aroused amongst the native holders, public meetings were held at which District Officers were occasionally present. At these meetings, the scheme and bye-laws were explained in detail and questions were invited. When sufficient support was forthcoming, provisional organising committees were appointed to enrol members, to schedule the acreage and amount of rubber affected and to secure signatures under the binding agreements prescribed in the bye-laws.

Whenever the total area owned by the prospective members exceeded 200 acres, application was made for registration under the Co-operative Societies Enactment of 1922 and a permanent committee of management was appointed with a President and Vice-Presidents, who were usually the Collector of Land Revenue, Assistant Collector of Land Revenue or District Officer and Assistant

District Officer, as the case may be. Malay officers assisted the members of the Committee to collect share capital and entrance fees.

At several centres, small-holders have exhibited great interest in the scheme, and at three centres in particular have expressed a desire to establish factories at the earliest possible date.

One of the chief difficulties encountered has been the collection of share capital from members, owing to the very low price of rubber which prevailed throughout the year 1929. In view of this, it was obvious that in most localities, a considerable proportion of the capital would have to be borrowed if societies were to begin operations at an early date. The local banks, the Planters' Loans Board and certain co-operative thrift and loan societies are prepared to lend money at a reasonable rate of interest. The members themselves are offering their title deeds as security for the borrowed capital. The repayment of the capital will be effected by a deduction of two cents per lb. from the money realised from the sales of rubber as prescribed under Bye-law 29. This fund should also ultimately provide for costs of supervision of the societies as required by the Registrar and provided in the Bye-laws.

Local rubber dealers have been interviewed regarding the purchase of the rubber and no difficulty in marketing in bulk on good terms is anticipated.

A system of book-keeping specially adapted for the use of societies has been evolved and specimen books have been printed.

Plans and specifications of the proposed buildings have been prepared. The factories will be capable of dealing with a crop from about 500 acres of mature rubber and the possibility of extension has been allowed for, as it is anticipated that many more people will become members when the factories are at work.

Three societies have been registered, the particulars of which are as follows:—

The Ulu Gombak Co-operative Rubber Society, Ltd., was registered on the 23rd August, 1929. The area of operations is in the Mukim of Setapak, 8½ mile Bentong Road, in the neighbourhood of the village of Ulu Gombak, Selangor, and is bounded by a radius of one and a half miles from the 9th mile stone. Within this area there are approximately 1,000 acres of mature rubber and further areas are adjacent. The present membership consists of 65 Malays owning approximately 205 acres of mature rubber.

The capital required for buildings, plant and machinery is estimated at $3,500. The paid-up capital to date amounts to $615.00 of which $600 has been paid to the Society's account at the Hong Kong & Shanghai Bank, Kuala Lumpur. Further subscriptions are being collected. Arrangements have been made to borrow the balance required up to a maximum of $3,000 at 8 per cent. per annum, from the Malay Officers' Agricultural Department Thrift & Loan Society, Ltd. A leading committee member has offered to place his title deed to a valuable holding as security. It is estimated that this capital will be repaid in about two and a half years on present membership, but the period will be reduced if the membership increases.

The site for the factory is situated at the 9th mile, Bentong Road. Application was made for the site on the 14th August, 1929. In December, the Selangor State Council approved of excision of the required area from the Malay Reservation, in order to legalise the position. The demarkation survey and the grant of the title may be expected to be completed early in 1930. Tenders for the erection of the buildings have been received from contractors at reasonable rates. The factory and smoke house with which it is proposed to commence will cost on contract $2,200 and the balance of the estimated capital is regarded as ample to complete the purchase and installation of necessary equipment for the factory, development of site and provision of water supply, etc. This plant will be large enough to cope with a production in excess of that anticipated from the present membership.

The Dusun Tua Co-operative Rubber Society, Ltd., was registered on 23rd August, 1929. The area of operations is in the Mukim of Ulu Langat, in the neighbourhood of the Dusun Tua Sanatorium, Selangor. In this locality there are large areas of small holdings of rubber. The present membership consists of 47 Malays, owning approximately 229 acres of mature rubber. In the case of this Society, the estimated capital requirements are similar to those of the Ulu Gombak Society quoted above. Members have paid up share capital and entrance fees to the amount of $570, which has been deposited in the Society's account in the Hong Kong & Shanghai Bank, Kuala Lumpur. Further share subscriptions are being collected. It is proposed to collect and retain as security, titles from those members who are unable to pay up the subscribed share capital. The repayment of the capital will probably be accomplished within the same period of time as that estimated in the case of Ulu Gombak Society. A site for the factory, on the road side, in the quarry reserve opposite the Sanatorium was applied for on 14th August, 1929. This application was refused on 24th September, 1929. Application was made on 29th October for an alternative site comprising two pieces of land situated at a distance of about 100 yards from the road in rear of the land first applied for. The two pieces of land are one-fourth acre of lot 590 Mukim of Ulu Langat and a portion of the access reserve adjoining it. The owner of lot 590 has expressed his willingness to sell the one-fourth acre at a price of $100. As in the case of the Ulu Gombak Society, the Selangor State Council in December approved of excision of the required area from the Malay Reservation. The matter of tenders and contractors for the buildings is receiving attention.

The Bendang Siam Co-operative Rubber Society, Ltd., was registered on the 17th January, 1930. The area of operations commences at the 6¾ mile from Taiping on the Sitiawan Road in the State of Perak and extends to the 10th mile covering an area about one mile wide on either side of the road. Within these boundaries there are approximately 1,500 acres of mature rubber. Two provisional sites for building purposes have been selected near the middle of the block.

Transport would be relatively simple as the main Government road runs through the middle of the area.

In this area there are two Rural Co-operative Credit Societies through which propaganda work is being continued. Most of the members of the Rural Co-operative Credit Society who own rubber land have become members of the Bendang Siam Co-operative Rubber Society, Ltd. Up to date, 90 people have become members and signed the binding agreements.

The area of rubber owned by the members amounts to 316 acres. The members have all joined since November, 1929, and the progress made in respect of membership up-to-date is so satisfactory that it is anticipated that many others will join in the near future. At a meeting dated 6th December, 1929, those present unanimously agreed that no sums should be borrowed, but that all the required capital should be subscribed by members. Share capital is now being collected and since 26th November $293 has been paid up, but with the price of rubber at its present figure, it will take some time before it is possible for all the share capital to be forthcoming. The residents are mostly Patani Malays and are permanently settled in the locality. From observation made they would appear to be relatively free from debt.

Further propaganda for the formation of co-operative rubber societies is in progress in the following districts:—

*Batu Kurau.*—Batu Kurau is situated about 15 miles from Taiping, Perak on the Ijok Road, where there is a relatively large area of Malay-owned rubber. So far, 60 people, owning approximately 200 acres of rubber, have signified their intention to form a Co-operative Rubber Society.

*Temoh Station, Perak.*—The approximate area owned by members who have expressed willingness to join amounts to 185 acres.

It is intended to concentrate upon the above-named societies as object lessons for Perak and Selangor, but to continue propaganda in other localities.

# RINDERPEST.*

BY

R. MACGREGOR,
*Government Veterinary Surgeon, Pahang West.*

In Malaya, Rinderpest is called Hawar Kerbau or Hawar Lembu. In Ceylon, Narakali. Bengal, Boshonto; in Europe, Cattle Plague or Cattle Typhus.

This cattle disease, which is apparently frequently introduced from countries adjoining the northern boundaries of the Malay States, has caused extensive loss to Malaya through the death of nearly all buffaloes which become infected. In recent years, the outbreaks have been frequent and the reduction of the numbers of buffaloes from this cause in padi growing areas has become very serious; so much so that the acreage under rice in districts where the disease has been rife has been steadily declining. The disease is not always present in Malaya, outbreaks occur chiefly in quarantine stations in cattle imported from Siam and sometimes from India. The source of infection of some outbreaks cannot definitely be traced; there is often a suspicion that cattle have entered the States and have avoided quarantine.

Wild pigs are sometimes blamed for carrying the disease as dead pigs have been found in districts where a sudden outbreak has occurred.

The movement of infected animals, or animals in an incubation stage or contact animals is perhaps the chief method of spread. The buffalo is the most susceptible Malayan domestic animal, in about 98% of infected animals of this breed the attacks proves fatal. The Deli or Murra milking buffalo is said to be intermediately susceptible between the Indian oxen and the Malay buffalo.

The ox is not so susceptible, but the local breeds are not so resistent as the imported Indian bullock; mortality of local stock may be as high as 90% while only 30% of Indian imported stock may succumb to the disease. Sheep and goats are said to be immune from natural infection.

Chinese-owned buffaloes are reputed to be more immune to rinderpest than those owned by Malays, and if attacked they are said to have a greater resistance to the disease. Records collected by the Veterinary Service do not support either contention; but because these animals are usually stall-fed and not allowed to mix with wandering Malay buffaloes, or become associated with the wild pig, they often escape contact with affected animals.

The wild pig is considered to be very susceptible and becomes an important agent in transmitting the disease from one place to another and also for maintaining the disease.

*Symptoms.*—The animals have inflamed eyes, with at first a watery

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* Abstracted from an Official Memorandum by Mr. R. Macgregor, Government Veterinary Surgeon, Pahang West.

discharge later becoming thick and white. If the lungs are affected, the animal may have a cough; the muzzle is dry and cracked and the breath has an offensive smell; the temperature may be 106° or more. If the animal survives for two days, the mouth lesions become pronounced and diarrohea occurs, the dung being sometimes bright red, but generally black and foul smelling. Occasionally, black urine is passed. In fatal cases, the temperature falls rapidly. Some animals survive until the seventh day, but they often later have a relapse and die.

A redness may be noticed on the paler areas of the skin in the early stages, animals that survive to the later stages may have a dry, cracked and very red skin. A post-mortem examination after the second day will show that the alimentary canal is ulcerated.

## Control of the Disease.

In Malaya, no method has been tried which has proved to be entirely satisfactory for immunising stock against the attacks of rinderpest. Some successs has apparently been obtained by inoculations and vaccinations. Such preventive methods are often very expensive and there is some doubt whether the actual inoculations have been the cause of immunity of treated animals. Investigators in Tanganiyika colony and the Philippine Islands claim to have had good results with one or more methods of inoculations and vaccinations. There is a danger of introducing other diseases, as it is difficult to provide a virus free from other infection; also the reaction to rinderpest might revive old infections of various blood parasites in treated animals.

Mr. S. L. Symonds, late Veterinary Surgeon, Selangor, stated that "Rinderpest is not indigenous to Malaya, but is frequently imported from Siam and India, under these conditions efficient quarantine must always remain the chief safeguard against this disease; the danger lies in cattle crossing boundaries into the States and avoiding quarantine".

If an outbreak occurs in a district, the quarantines order that—"all cattle shall be confined to their owners' premises means that cattle shall be kept adjacent to the owners' house, and that calves, or cows must not be permitted to ramble about at night."

Great care must be exercised by owners that they do not carry the disease to neighbouring holdings on their clothes, feet, or the wheels of vehicles.

The only way to stamp out the disease is to carry out the rigid quarantine regulations as laid down by the British Resident. The serious losses incurred to a district by an outbreak warrants the levying of heavy fines on any person breaking the quarantine regulations. Several outbreaks during the past few years have continued for months, gradually spreading from one place to another, until exemplary fines were imposed on owners for not complying with quarantine orders. As soon as the owners realised that the orders had to be obeyed and not evaded, the disease gradually died out in each case.

## Principal Medical Officer's Circular 25 of 1928.

Rinderpest is an acute infectious, contagious febrile disease chiefly of cattle caused by ultra-microscopic virus. In England the disease is known as Cattle Plague.

The disease has not been indigenous to Malaya for many years, but sudden outbreaks occur from time to time and in many cases the origin of the infection cannot be satisfactorily traced. (These are apart from the outbreaks that often occur in cattle quarantine stations amongst imported cattle). The disease affects cattle, oxen and buffaloes—and is of great importance to the Malaya farming population as the Malayan buffalo is exceedingly susceptible and the mortality is very high, 98 to 99 per cent. In the outbreak in the Tampin and Kuala Pilah districts of Negri Sembilan in 1926 only 12 buffaloes recovered out of 1,156 affected, while the total loss in buffaloes, including those slaughtered for food or sold to butchers was nearly 3,000. In many kampongs all the buffaloes were lost.

Experience shows that the only reliable method of control of the disease in this country is strict quarantine and prohibition of movement of affected and contact animals, and success depends on the degree to which this is obeyed or can be enforced. A recent report from Tanganiyika Territory also emphasises the importance of rigid quarantine measure for controlling the disease. In Tampin district in 1926, quarantine was generally well observed and the disease held in check, and in one or two places was restricted to the originally affected animals. The spread from holding to holding, when such did occur, was traced to illegal movement of animals or attempt to conceal the disease. This movement of animals was generally deliberate. In parts of Kuala Pilah district, quarantine was evaded as much as possible, any excuse being offered and the disease persisted for six to eight months, until in many small holdings there were no more buffaloes left to contract the disease. On several occasions, the introduction of an infected or even a contact buffalo into an unaffected holding has resulted in the loss of all the buffaloes of that homestead.

To make quarantine really effective it is necessary that, whenever a quarantine order has been made by the Resident on account of the rinderpest, breach of such order should be looked on as a very serious offence and exemplary fines or other sentences imposed. It is certainly a more serious offence than merely "straying cattle." In the Raub District of Pahang in 1928, after the disease had been in existence there for nearly eight months, a few exemplary fines were imposed in August instead of the previous small fines: the disease cleared up in September and in November the district was cleared free of Rinderpest.

# ABSTRACTS.

## CO-OPERATIVE MARKETING BY SMALL-HOLDERS.

The Year-Book of the Department of Agriculture, Gold Coast, contains an article* which embodies the views of that Department on the subject of organising the sale of cacao from small holdings. The difficulties that face the Gold Coast administrators in the marketing of some 220,000 tons of cacao, being the annual crop from about 900,000 acres obtained from 150,000 owners and marketed in 1,200,000 small lots, find a close parallel in Malaya with its enormous area of rubber and coconuts owned by small-holders. The following resume of the position in the Gold Coast and the scheme of marketing the cacao crop is of interest in view of the scheme inaugurated in the Federated Malay States for the establishment co-operative rubber factories, an account of which will be found in the present number of this Journal.

In the Gold Coast, there are 150,000 owners of cacao land, the average area owned by each being about six acres, with an annual out-turn of 1½ tons of cacao each. Further, the crop from each holding is reaped four times annually, so that 1,200,000 lots are reaped, prepared and sold. It is entirely a peasant industry, the bulking of produce from several farms being rarely practised. Consequently, there is considerable lack of uniformity in the product. Defects are partly seasonal, but in general they arise from inefficient methods of reaping, fermenting and drying. Defects and lack of uniformity in produce are characteristic of unorganised peasant industry in any country and are not peculiar to the Gold Coast. The effective remedy—as has been introduced into India, Ceylon, Mauritius and Malaya— is co-operative preparation and co-operative marketing, and it is applied in progressive countries by the private enterprise of the farmers themselves. The effect of lack of organised methods of preparation and marketing is shewn by the fact that the Gold Coast producers lose from £7 to £10 per ton over organised competitors in other countries. To abolish this difference it does not suffice merely to improve the quality. The industry must be organised in such a manner that the manufacturer can make contracts ahead with complete assurance as to good quality and uniformity.

The effect of individual preparation and marketing on local prices is even more serious. It brings into being the petty itinerant buyer and the broker as the merchant cannot deal individually with each of the thousands of small holders, and this in turn leads to the system of advances to producers. The whole task of financing the crop and its subsequent treatment till it is shipped is then left by the farmer to the merchant. This unsatisfactory system is equally against the interests of the producer and the merchant. From the point of

* Paper No. 1 "Local Cacao Prices and the Standardisation of Quality". Year-Book 1928, Department of Agriculture, Gold Coast. Published 1929.

view of Government, the present position regarding preparation and marketing is unsatisfactory because there is increasing friction over questions of price and because quality is becoming more and more a factor determining prices in the world's markets. It is held that the radical problem is not merely the standardisation of quality, but it must attack the radical problem of the farmer's finances.

The Gold Coast Department of Agriculture planned a co-operative unit of seventy-eight farmers for the preparation and marketing of their crop. The result of this experiment in co-operation was that not only were all intermediate charges cut out, but the first lot sold at £3.14s. and the second lot £4.12.6d. per ton above the local broker's price. Further capital was provided, the farmers subscribed (in shares of 1s. each) £160 in a fortnight. This enabled spot-cash to be paid for each lot brought in and overcame the tendency towards intermediate sale. Such a system finances the farmer, especially during the winter crop, is effective in improving the quality of the product, stabilises and improves the relations between farmers, merchants and Government and finally reduces waste of time and money.

The above is an instance of a small primary unit. The second step is the formation of larger secondary groups of units. Secondary groups should not be formed by fusion but by confederation of primaries, because the primary must be small enough for members to know each other intimately, and for methods of book-keeping and accounting to be simple. The assumption of an Agricultural Bank, entirely capitalised by Government or by some other body external to the farming community is unsound for three reasons: firstly, it would encourage rather than discourage thriftlessness. Secondly, adequate security is not obtainable from individual small farmers under present local conditions. Thirdly, no central bank can hope to fill the petty, recurrent needs of individual small farmers. In an effective system, primary societies fill petty personal needs, secondary federations handle joint needs, and group of secondaries are real, living and effective banks.

There are reasons for believing that the system considered in the Gold Coast would grow rapidly, too rapidly for safety in the early stages. Very rigid, thoughtful control would have to be exercised by Government. If the scheme became a complete one, covering the whole cacao crop, the number of primary units would not be less than 1,500 and two lines of control would have to be established. Inspection and certification of produce would be performed by the Department Inspectorate, supervision of books and accounts by the Economics Division.

# WILT DISEASES OF COCONUT PALMS IN TRINIDAD.*

In these papers, attention is drawn to diseases of the Coconut Palm in the West Indies which terminate in a rotting of the bud. The diseases mentioned are:—(1) true Bud-rot, primarily caused by a fungus (*Phytophthora palmivora* Butl.), in which the bud and the central spear of unfolded leaves are first attacked, (2) "Red Ring disease", caused by eelworms, in which the older leaves are the first to wither, although the final stage results in a decay of the bud, (3) "Tapering Stem Wilt or Yellow Leaf Wilt", and (4) "Bronze Leaf Wilt" which forms the main subject of the papers.

If the three lowest and oldest leaves of a palm become discoloured bronze, coupled with an increasing yellowing at the tips of the next two or three leaves, the palm is probably affected by Bronze Leaf Wilt or Red Ring disease. The stem tissues however are not as a rule discoloured in the case of Bronze Leaf Wilt disease, but if eelworms are responsible the discolouration is very evident. As Bronze Leaf Wilt disease progresses, the yellowing of the leaves extends to the still younger leaves. When only four to six of the lowest leaves are discoloured the tender crown tissues are healthy, but later, a bacterial rot sets in at the base and in the folds of the still green leaflets of the central spear of leaves. The rot later extends downwards into the cabbage, and develops considerably before the central spear of leaves changes colour. In the later stages of the rot they wilt, turning a dull greyish-brown colour, and fall over at the base. A shedding of green nuts takes place, at the same time or slightly in advance of the discoloration of the leaves. Similarly, especially in the lower ones, the swords or spathes turn brown, from the tips backwards towards the base, slightly in advance of the discoloration of the tips of the leaves in the axils of which the swords are borne.

No root-invading organism has been associated with the disease, which is considered to be due to "drought" i.e. to a combination of factors, including the soil moisture factor, which is to a large extent dependent on the tilth, texture, humus content, etc., of the soil, together with unsuitable, and in many cases definitely injurious, agricultural operations. There is also the impression that possibly waterlogging will bring about the same result, but the writer considers it advisable to prove this by further observations and experiments before any further statement can be made. The disease is worse on low-lying, badly drained land, and on lands with a permanent water-table four feet or so below the surface of the soil. In Trinidad, however, on certain coconut areas, the land becomes waterlogged in the wet season owing to a heavy subsoil. In such soils, the effective root system is confined to the top nine inches or one foot of soil. In the dry season, this top soil becomes excessively dry within a few weeks and Bronze Leaf Wilt sets in at a later date. In soils of this nature there is

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* H. R. Briton Jones. Part 1. Supplement to Tropical Agriculture, May 1928.
Part II. " " " " Dec. 1929.

little or no upward movement of the sub-soil water. There is also a definite seasonal variation in the incidence of the disease which is correlated with wet and dry seasons.

The disease has been reproduced experimentally in healthy palms, by digging a trench around the palms one foot wide, three feet deep, and at five feet distance from each palm. Other palms were treated by digging the soil on one side to a depth of three or six inches, thus cutting the root system. In a fortnight or three weeks the earlier symptoms of Bronze Leaf Wilt appeared on the trenched palms and appeared, on the palms treated by digging, on the treated side only.

Three palms suffering from the disease were watered periodically during the dry season from February to May. One of the palms was badly affected (10 bronze yellow leaves), but the other two were in an early stage. In these two palms the progress of the disease was arrested by the month of April, and they were healthy and cropping well in December. The badly affected palm died in May.

Subsequent observation shewed that a certain percentage of palms recover naturally, but the recovery is not necessarily permanent. Some palms may recover several times but in a very large number of cases the palms die.

Control measures are discussed under two headings, (1) "preventive measures" to be applied to young plantations and to those lands not yet planted with coconuts and (2) "palliative measures" to be applied to established plantations in a cropping condition. The ultimate aim of these measures is to obtain improved soil conditions so that paying crops of coconuts can be secured. The question of drainage is discussed at some length, and it is pointed out that drainage must not be overdone. Drainage systems on coconut areas in Trinidad are complicated by the fact that much of the land was formerly under sugar cane, and it is still customary, for the first few years, to grow sugar cane as a catch crop. The writer outlines a change of drainage system which will bring the palms more into the centre of the bed, and in which soil, weed brushings and lime are placed in the old drains, and the reformed beds are round ridged to ensure efficient running off of the water.

Cultivation of established coconuts is not recommended in Trinidad for fear of root injury. The writer favours covering the land with a vegetable mulch in the dry season by cutting the weeds which are allowed to grow in the wet season. Weeds assist in getting rid of excessive soil moisture in the wet season, but should not be allowed to grow in the dry season as they further reduce the available moisture. To replace weeds by a cover crop, on established plantations, is considered to be inadvisable since it would mean cultivation.

The writer also considers that coconut palms in Trinidad are planted much too close, generally at what appears to be just about half the proper distance apart, and recommends that every alternate palm should be cut down in order to provide more root room for the remainder. "Taking the effective root range to be one foot in depth, and the average width of the beds and distance of

planting to be fifteen feet, it follows that the coconut palm has 225 cubic feet of poor soil from which to obtain its nutriment and water supply. It is no wonder, therefore, that the palms take fifteen years to produce a crop, and that, as a result of its production and the additional strain on the root system the palms die from Bronze Leaf Wilt." The control measures suggested by the writer are being tested on a financial basis on a group of estates in Trinidad, to see if control of the disease is possible on an economic basis. Research work on soils is required to work out the technique, by means of which it would be possible to decide what lands can and cannot profitably be planted up with coconuts.

In Malaya, Sharples* has obtained evidence that on well run estates, palm diseases which may end in a rotting of the bud are largely due:—(1) to the effect of lightning strike or (2) are influenced to a certain extent by the presence of a fungus (*Marasmius palmivorus*) on the leaf bases and strainers.

Actual lightning strikes have been observed and the after-effects were similar to those found in other cases where lightning was suspected. A recent paper entitled "Lightning" by Dr. G. C. Simpson, C.B., F.R.S., published in a supplement to "Nature" Nov. 23rd, 1929, gives an interesting account of the mechanism of thunderstorms. Dr. Simpson's conclusions that discharges from positively charged clouds are frequent but comparatively weak, while those from negatively charged clouds are infrequent but strong, make it possible to offer a reasonable explanation of the sudden appearance of lightning strike symptoms in large areas, and small and scattered areas, of coconut palms.

Where palms are grown in Malaya on poor soil, or where they are given bad treatment, they may develop external symptoms similar to those described for Bronze Leaf Wilt in Trinidad—which is only to be expected. In addition, leaf fungi such as *Pestalozzia palmarum* and various *Ascomycetes* may become prominent. The effects of lightning and of *Marasmius palmivorus* have been observed on areas where soil or growth conditions could not be considered in any way responsible.

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* Sharples, A. Palm Diseases in Malaya. *Malayan Agricultural Journal*, Vol. xvi, Nos. 9 & 10, 1928.

# SOIL MANAGEMENT:

## Particularly with Reference to Coffee Cultivation.*

A soil rich in plant food is not sufficient in itself to supply the essential factors for plant life.

In an analysis of any crop, moisture is always first determined and is always present to a greater or less degree, but the amount of water used by the crop is not measured entirely by the amount contained in the plant at any given time. Investigations in the field and in culture solutions have shown that the root hairs of the plant are constantly absorbing water which ascends through the roots, stems and branches to the leaves from which it is evaporates into the air. The amount of water which passes through a crop in this manner is enormous, amounting to roughly 500 lbs. for every pound of dry matter produced. This water acts as a vehicle for mineral plant foods, controls the temperature of the plant and is all-important in plant processes. In a climate like this, where bursts of rain are followed by more or less long dry periods, it is particularly important to conserve the water supply. Unfortunately, the elements are still beyond our control and farming continues to be a huge gamble, we are told; but it is interesting to realise that we can always increase the odds in our favour by skilful soil management.

Another important factor is air. A water-logged soil is just as unhealthy for most plants as an extremely dry one, because it sets up rotting in the roots and eventually kills the plant. Thus, the ideal soil is one which is highly retentive of water and yet never water-logged.

Such a soil must have a high percentage of pore space, that is a granular soil. A powdery soil has a low pore space and is very subject to wash and erosion. These two factors, water and air, are just as important as plant food, which will be considered last because it rarely consists of more than five per cent of the crop. The main food factors are nitrogen, phosphorus and potash. There are comparatively few soils which do not contain sufficient of these materials for the crop, although there are many soils on which dressings of either or all of these materials give an increased yield. The reason is, that in many soils, these materials are not available, meaning that they are not in a fit state to be absorbed by the plant roots. Good soil management supplies the remedy of these cases, as will be seen later.

This leads to the subject of the economics of manuring. One can only decide whether a manure will pay by carrying out field experiments. Try the manure on a few lines and leave others as controls and take yields and costings

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* Abstract from a paper read at the Annual Conference Uganda Planters' Association, June, 1928, by W. S. Martin, M.Sc., Ph.D., A.R.C.S., D.I.C., A.I.C., Agricultural Chemist, Department of Agriculture, Uganda Protectorate. Circular No. 21, Department of Agriculture, Uganda Protectorate.

as accurately as possible. Such experiments must be carried out for the particular estate because the response of different soil types to manure varies.

Although it is essential to have plenty of mineral plant food latent in the soil particle, a relatively small quantity available at a given time is sufficient for the plant's needs, something of the order of fifty to one hundred parts per million of the soil solution. It is the aim of good soil management to render available the plant food material already present in the soil before thinking of artificial fertilisers.

The majority of the plantations in Uganda have been opened up on elephant grass land. Such land has usually a deep soil of good structure. The first few crops taken off this soil are invariably good, but fall off gradually. An examination of soil from such an area may show that it is a mixture of good crumbs of varying sizes, or it may be fine and dusty. The latter state is chiefly the result of clean weeding, necessitating frequent hoeings which continually add to the quantity of pulverised material. The fine dusty soil has a minimum of pore space and water-holding capacity. In a wet season it easily becomes water-logged, inhibiting the growth of the tree owing to lack of air; while early in a dry season it has dried out and caked, making the crop suffer through lack of water. A comparison of the soil on an old coffee plantation with the virgin soil of elephant grass land ten yards away revealed the fact that the top soil in the first instance was very fine and dusty, four inches in depth, with no crumbs, while the virgin soil adjacent was good black soil fifteen inches deep, and well granulated.

In a comparatively short time a good soil in excellent tilth had been ruined by bad management. Clean weeding and cultivation had allowed the sun to burn out all the humus, which acts as a cement for the particles in the granule; rains had carried a lot of the soil away, and the wind was doing its best with what was left. The crop was round about 2 cwts. per acre, but this is not surprising in view of the above remarks on the water and air requirements of the plant root.

How can a good soil structure be maintained? It is seen that hoeing and clean weeding reduce the good structure to dust, brings humu to the surface to be burnt out, until finally all the humus is removed, granules are non-existant, pore space is at its minimum, heavy rain tends to wash much of this soil away, and sun following rain bakes the remainder resulting in something harder than a road.

The remedy, the secret of soil management, may be expressed in one word—Humus.

Humus puffs out or lightens a heavy clay soil owing to the carbon dioxide produced by the micro-organisms living in it, much in the same way as yeast lightens dough. Humus is also invaluable as a cement for giving a good crumbly tilth on light sandy soils. It also has a very high water retaining capacity which proves its value in drought periods.

Organic matter is the only possible food for the micro-organisms in the

soil, it is oxidised under the influence of these organisms which derive their energy from the process. Oxygen is taken up and carbon dioxide given off. This carbon dioxide dissolves in water giving a weakly acid solution which slowly dissolves plant food from the soil particles. In this way it is obvious that a soil with a large quantity of organic matter has a big population of micro-organisms, more carbon dioxide formed, a stronger carbonic acid solution and so a better chance of obtaining the mineral plant food, phosphate and potash, from the particle.

The supply of nitrogen is more directly dependent on humus than on the mineral foods of the particle. The organic matter in the soil consists of plant residues containing nitrogen which is released and made available for the plant as nitrate as a direct result of the activities of certain groups of organisms.

Other organisms deriving the necessary energy from the decomposition of humus, are able to fix atmospheric nitrogen, giving ammonia which is converted to nitrate by other organisms. Soils rich in organic matter may contain up to 1 per cent nitrogen, while in dead unfertile soils it rarely exceeds .05 per cent or 1/20 of the previous figure. On all counts, humus is essential for a soil to be fertile and it is mainly the loss of humus which has caused the gradual decrease in crop.

There is a close relation between the incidence of sucking pests and soil conditions. A healthy tree is much less likely to be attacked than a less healthy one. An instance of this is the "root mealy bug" which has been observed to do greater damage during periods of drought on soils with a poor water content, and in exceptionally wet weather on water-logged soils. In the first instance the direct cause was water starvation and in the second air starvation. The very best means of prevention is the application of humus, which increases the water retaining capacity and at the same time improves the structure and facilitates drainage.

The conclusion is that humus in the soil is most necessary: but how can it be obtained and applied?

The first and standard method is green manuring, that is, the growing and digging in of a green crop. Leguminous crops are usually chosen because they have the additional advantage of a bacterial organism, living in symbiosis with the roots, which fixes nitrogen from the air. Thus, legumes contain more nitrogen than any other crop but it does not become available for further crops until it has been ploughed in and acted on by other organisms. There is an erroneous impression that the nitrogen fixed by legume organisms is made available for other crops during the growth of the legume.

The Author instances elephant grass as an excellent mulch for coffee, but points out the danger of fire from such a mulch. Cattle manure and rotted cotton seed are also mentioned as proving useful for supplying humus.

In opening up new ground, it must be remembered that the burning of organic matter in clearing means a complete loss of valuable material and should be

avoided as far as possible.* It is important to keep the soil covered from the very beginning, because more damage is done when the coffee is young and the soil completely exposed.

Shade trees may or may not be necessary for coffee. In any case, shade is essential to conserve the all important humus.

The policy of doing nothing with the soil because it is so good that it needs nothing putting back, cannot be maintained. It is much easier and a better proposition to keep a soil in good heart than to put life into a dead soil. The policy should, therefore, be to start right by putting something into the soil each year as the crop takes its toll.

Remember that many weeds appear to be able to thrive where the main crop shows signs of failing. When these weeds are dug in and acted on by micro-organisms, the food which they have wrung from a reluctant medium becomes available for the main crop.

Lime is well known for its action in flocculating or forming granules in stiff clay and in changing the reaction of sour soils. Both these properties are valuable in improving the condition of life of the micro-organisms. Where active steps are being taken to conserve and increase the humus content of the soil it would be wise to experiment in the use of lime.

## ESTIMATE OF PRODUCTION AND CONSUMPTION OF CRUDE RUBBER DURING THE YEAR 1930.

While the production of crude rubber will increase in 1930 by 68,000 tons over that of 1929, consumption will increase at the lower rate of 45,000 tons is the estimate of "The Rubber Age" of January 10th, 1930, contained in an article on the above subject. The average increase in consumption over the past six years has been 16 per cent per annum. During 1930, it is doubtful whether it will be more than 4 per cent. High stocks in hand and afloat to consuming markets and low consumption in the United States for the last three months of the year, coupled with high production of crude rubber on the estates and by native interests, is held responsible for the position.

The article concludes that the market price of crude rubber will show no advance during the year. The price will therefore be more stabilized than during any previous yearly period. On the other hand, the market price will not materially affect production during 1930.

Reclaimed rubber is expected to maintain its present position (50 per cent to the amount of crude). If crude rubber drops to below 15 cents (Gold), this rate may decline to around 40 per cent.

* The Author is here dealing with elephant grass land. In Malaya, when virgin jungle land is being opened, this destruction of organic matter seems to be inevitable. The best method of preventing loss of organic matter in such cases is to establish a cover crop as soon after the burn as possible before the humus and surface soil have been materially changed by the action of rain and sun.—Editor, M.A.J.

# REVIEWS.

## The Culture of Vegetables in Malaya.

BY

B. BUNTING AND J. N. MILSUM.

*Special Bulletin. General Series No. 1. Department of Agriculture, S. S. and F.M.S., 78 pp. and Index. 12 Pls. Federated Malay States. Price $1.50 (Straits Currency) Post free.*

In 1919, a bulletin was issued by the Department of Agriculture, S.S. and F.M.S., giving information concerning the cultivation of vegetables. This publication went through two editions and has been out of print for some time. The present bulletin has therefore been published in response to frequent requests for information on this subject.

The subject matter of the original bulletin has been completely revised, re-arranged and re-written, while the twelve full-page illustrations of the present volume are new.

"The Culture of Vegetables in Malaya" is arranged in eleven sections, viz.—climatic conditions, selection of site, soils, soil operations, manures and manuring, source and storage of seed, rotation of crops, watering, pests and diseases, vegetables suitable for different conditions, vegetables—description and methods of cultivation. It is thought that the above arrangement of sections will facilitate ready reference, for the amateur gardener generally requires a book of reference rather than a bulky treatise on the subject. For the same reason, the information has been stated as concisely as is compatible with clarity.

The vegetables suitable for cultivation in Malaya have been classified as follows:—

Low elevation —for small gardens; 14 varieties.
—for large gardens; 26 varieties.
—for coolie gardens; 21 varieties.
High elevation—for hill gardens; 26 varieties.

Following this classification, a description is given of the appearance, habits, cultivation and uses of sixty varieties of vegetables.

Disappointment in growing vegetables is frequently caused by the ravages of pests and diseases—especially the former. Some knowledge of the insects to expect and the methods of successfully combatting them is essential for obtaining even reasonably good results with the garden. The Mycologist and Entomologist in the Department of Agriculture have collaborated with the Authors in the preparation of the section dealing with this subject. Information is given not only on the nature of the more usual pests and diseases, but on the methods recommended to keep them under control. With this informa-

tion, it should be possible for the reader to protect his crops adequately from the damage occasioned by pests and diseases.

But however thorough a book on this subject may be, it must be remembered that personal interest in the garden is essential. The usual type of native gardener will achieve little success if the planting material and the instructions are given him, but he may frequently be stimulated to activity when he is aware that his master is personally interested in the venture.

"The Culture of Vegetables in Malaya" is recommended to all gardeners in this country. In method of presentation it is easy to follow, and its cost—$1.50 post free—brings it within reach of all.

D.H.G.

## On Chinese Medicine:

## Drugs of Chinese Pharmacies in Malaya.

BY

DAVID HOOPER, L.L.D., F.C.S.

*The Gardens' Bulletin, Straits Settlements, Vol. VI. Part I, Issued December 1929, Botanic Gardens, Singapore. pp. 154 and Index. Price $2.50*

"On Chinese Medicine: Drugs of Chinese Pharmacies in Malaya" by Dr. Hooper gives a very detailed account of the various remedies employed by the Chinese both in China and Malaya. The Author includes both official preparations and domestic remedies and all the substances described have actually been found in Malaya. There are 456 substances enumerated, all of which are named in Chinese, Romanised Mandarin and as far as possible, in English. Drugs of vegetable, animal and mineral origin are described.

Although the plant products include such well-known European medicines as cinchona, Hydnocarpus, croton and castor oil seeds, it is remarkable that on account of the poisonous nature of croton there are legal obstacles to its sale, while castor seeds are used, in the form of a paste for external application. Other remedies are mangosteen-rind, mother of ants eggs, radish, onion, plantain, mallow, 'lallang'; in fact, there appears to be no plant which the Chinese do not allege to possess curative properties.

In the animal and mineral kingdoms the list of drugs appears to be only limited by the resources of China. As Dr. Hooper says, many of the animal drugs recall those found in European pharmacy 200 years ago. They range from asses' glue, excrement of various small mammals, worms and cockroaches, to the unattractive sounding "bug with nine smells." Mineral drugs include such well-known substances as Glauber salts, borax and calomel, but also include mica.

The Author enumerates the medicinal properties claimed for the various drugs, but does not confirm the validity of such claims. This is not very surprising when it is considered that the bones of tigers, leopards and lynxes are claimed to impart bravery and strength, that various dyes by virtue of their red colour are supposed to have a special affinity for the blood, that the seed of the Tree of Heaven, on account of its resemblance to the eye of a bird, is used in opthalmic diseases, while other drugs are claimed to be "The Elixir of Longevity" and "The Elixir of Felicity."

Of the 415 vegetable substances described, only a small proportion contain an active principle known to medical science. In spite of the absurd claims made for some of the drugs, the reader is impressed by the valuable addition to Western medical science likely to result from a detailed chemical and medical study of Chinese *materia medica.*

V.R.G.

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## INTERNATIONAL CONGRESS OF TROPICAL AGRICULTURE, ANTWERP, 1930.

An International Congress of Tropical Agriculture is to be held at Antwerp from 28th. to 31st. July, 1930, in connection with the forthcoming International, Colonial, Maritime and Flemish Art Exhibition (Antwerp, May to October, 1930), at which about 1700 sq. ft. of space have been reserved for agricultural and other exhibits from Malaya. It is anticipated that an officer of the Department of Agriculture, S.S. and F.M.S., will attend the congress, which is organised by the Belgian Association of Tropical and Subtropical Agriculture. The subscription to the congress is Ten Shillings (or 75 Belgian Francs), and applications for enrolment should be addressed to the General Secretary, 230 Rue Royale, Brussels, who will be pleased to give further particulars.

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# ENTOMOLOGICAL NOTES.

## FIRST QUARTER, 1930.

### Tea.

Mr. N. C. E. Miller, Assistant Entomologist, has commenced a survey of the insects of tea in Malaya and has visited six estates in this connection. It is hoped that he will visit all estates and native holdings in the Peninsula. To date he has found no insects of considerable economic importance, although at Cameron's Highlands, minor damage by *Helopeltis* sp. (Mosquito blight) to young leaves and by the caterpillar (cut worm) of *Agrotis ypsilon* to seedlings was observed. This cut worm appears to confine its attention essentially to the young seedlings and apparently causes no damage to the plants after becoming established.

An enquiry was received from an estate concerning the cricket, *Brachytrupes portentosus* Licht. and the Manager's description concerning the activities of this insect is considered worth recording.

" They appear to work only in the night and have not been seen in the daytime. After nipping off the young seedlings, they burrow down into the ground anything from 2″ to 4″ and travel along at this depth, sometimes two feet taking the foliage and stems with them. The specimen seedlings and leaves enclosed were recovered from the ground. The only trace left on the top of the soil is a small mound of earth. On scraping this away a hole is exposed and on following the hole traces of leaves and stems are found. After following the hole sometimes two feet or more the insect is discovered alive." Recommendations were made for the control of this insect, but the Manager had taken the matter in hand earnestly and had caused the burrows to be traced, catching thereby ' some 12 or more ' crickets.

### Coffee.

The coffee hawk moth (*Cephonodes hylas*) has been reported once during the quarter. This caterpillar is frequently very troublesome and has been known to increase to such numbers that bushes have been entirely defoliated and the berries subjected to attack. Spraying the bushes with lead arsenate has been successful, but reliance is often placed in hand collection. Comparatively recently the eggs of this moth have been found parasitised by a very active minute parasite.

The coffee berry borer (*Cryphalus hampei* Ferr) is a small beetle which bores the seeds of coffee. Coffee in Malaya has been observed with about 100% of the seeds infected. In such cases, a complete collection of all berries and the prevention of berries forming for at least six months were recommended. Such a procedure was strictly carried out on one estate with the result that the attacked berries were said to have been reduced to about 2 per cent. All

managers of coffee estates are urged not to introduce coffee berries from other estates unless accompanied by a letter or a certificate from the country of origin that the seed has been disinfected.

## Oil Palms.

An enquiry was received relating to 'white ants' damaging oil palms. With the exception of the destruction of all timber, no other effective control measure has been found. The mercuric chloride treatment which has come into prominence recently provides merely temporary relief and has to be continually repeated. This measure is only recommended where for the time being, conditions render the destruction of timber impossible.

## Coconuts.

The yellow nettle caterpillar (*Setora nitens*) has been troublesome in the Teluk Anson area. A paper dealing with this insect was written by Mr. Miller for the *Malayan Agricultural Journal* (Vol. XVII. No. 9 Sept. 1929) and managers of coconut estates would find this article of considerable assistance as it describes the appearance of the egg, caterpillars and cocoons and gives instructions as to control measures. In connection with this insect, it is interesting to note that a manager of an estate forwarded some Reduviid bugs (*Sycanus leucomesus* Walk.) which are predaceous on the caterpillars and since this is the first record of this bug being predaceous on *Setora* caterpillars his remarks are herewith quoted.

" This insect undoubtedly attacks the nettle caterpillar, and at the present time is to be found on almost every palm on our young clearings."

"This insect spears caterpillars of all sizes and generally has a dead caterpillar hanging on to its ' spear.' It undoubtedly helps to keep the nettle caterpillar on control.

" .................... also that it might be possible (if it has no other damaging properties) to encourage it to breed on coconut estates."

The adult bug is black with orange coloured wings and is about 20 m.m. in length. The nymphs (young bugs) are orange red with black markings. This insect has been recorded feeding on a number of other insects in Malaya. It causes no damage to plants and the nymps and adults undoubtedly should be protected.

Further observations on the greater coconut spike moth (*Tirathaba rufivena* Walk.) have been made. Removing the enveloping sheath just before the spike would burst to allow the inflorescence to spread quicker, has been demonstrated to control the caterpillars, and managers of estates are invited to remove the sheath from spikes on a small area in order to find out if an increase of nuts per acre is thereby obtained.

## Padi.

The continuation of the breeding of and liberation of egg parasites (*Trichogramma nanum*) to control caterpillar borers of padi have been continued

and whilst breeding of the parasites on the eggs of a grain moth has been carried out in Kuala Lumpur, Mr. H. T. Pagden, Assistant Entomologist, has been stationed, since the middle of February, in the Krian District of Perak, in order to make an intensive study of these borers and to observe the behaviour of the parasites in the field. It is interesting to record that during the months of January, February and March a total of about 3,000,000 parasites were despatched from Kuala Lumpur for liberation in the Krian district. At the present time, no definite statement as to the success or otherwise of this work can be given, but indications are not wanting that 'bored' padi in "liberation" areas is less than in "non-liberation" areas.

## General.

A most unusual outbreak of a *Cicada* occurred recently in East Pahang. Capt. J. M. Howlett, Agricultural Field Officer, Pahang East, forwarded a specimen of a coconut leaf shewing eggs in the mid-rib and sent information that he had found them in twigs of various other plants growing at the Experiment Station. He records the following plants attacked—*Tephrosia candida, Crotalaria anagyroides,* peach almond, banana, guava, pineapple, coffee, tomato, brazil nut, papaya, sennudok, coconut, soursop, quini and beraksa.

The cause of the damage is a green coloured *cicada*. The seventeen year old *cicada* in America is the classic example of this group of insects as it takes 17 years to reach maturity from the egg. This cicada damages fruit trees by laying its eggs in the twigs. Pruning and burning is postponed until egg-laying has been completed, after which prunings are burnt.

Advice was sought as to exterminating white ants from a building. The foundations of buildings should be made of cement concrete in which no lime has been incorporated. Lime is no material hindrance to the advance of white ants as they are capable of exuding an acid, thereby dissolving out the lime.

G. H. C.

*Forwarded for publication April 1st, 1930.*

# DEPARTMENTAL NOTES.

## Visit of His Excellency the Governor.

His Excellency, Sir Cecil Clementi, K.C.M.G., Governor and Commander in Chief of the Straits Settlements and High Commissioner of the Malay States, visited the Headquarters of the Department of Agriculture, Kuala Lumpur, on 15th March, 1930.

## Laying of Foundation Stone of the School of Agriculture, Malaya.

His Highness The Sultan of Selangor (Ala'idin Sulaiman ibni Almerhum Raja Muda Musa, G.C.M.G.,) accompanied by the Chief Secretary to Government, The British Resident of Selangor, the Director of Agriculture and other distinguished guests, laid the Foundation Stone of the School of Agriculture, Malaya, at the Government Experimental Plantation, Serdang, Selangor, at 4 p.m. on the 19th March, 1930.

The Director of Agriculture (Dr. H. A. Tempany) gave a brief account of the proposals which led to the erection of the present building and pointed out that the school should not be considered as filling all the needs of agricultural education in Malaya, but as one of the links of a scheme of education which would commence in the vernacular schools and terminate in this School of Agriculture.

His Highness, after performing the ceremony, spoke of the importance of education in agriculture, and the effect that it must have in improving crop production.

## The Director of Agriculture visits Perak.

The Director of Agriculture was on tour in Perak and the Dindings from 20th to 27th March. Among places visited was the important Kenas irrigation area and the Krian irrigation area.

## Economics of the Rice Situation.

The Director of Agriculture (Dr. H. A. Tempany) delivered a lecture on the above subject at a meeting of the Malacca Planters' Association on the 9th March, 1930. The subject is one of great importance to Malaya, for which reason a resume of the main points of Dr. Tempany's lecture will be published in the next number of *The Malayan Agricultural Journal.*

## Vernacular Publications.

The current number of *Warta Perusaha'an Tanah,* the agricultural journal in the Malay language, published quarterly, contains, in addition to an editorial, articles on A 'nettle' Caterpillar of Coconut Palms; Stem Borers of Padi; The Malayan Buffalo; Rinderpest; and School Gardens in Malaya. The journal,

now in its eighth annual volume, is becoming increasingly popular, 5,000 copies of each issue being distributed.

The Chinese Agricultural Journal commences its fourth year of publication with the issue of March 1930. It contains the articles on A 'nettle' Caterpillar of Coconut Palms; The Malayan Buffalo; Rinderpest; and in addition, an article on Education in Relation to Agriculture.

It will be seen that while some papers are suitable for publication in both of these journals, due regard is given to the fact that the Malay and Chinese agriculturists are at different stages of agricultural development, the subject matter for these publications has therefore to be very carefully revised to suit the requirements of each journal.

Articles that appear in *The Malayan Agricultural Journal* are rarely suitable for publication in either of the vernacular journals without considerable revision. Many of the articles in the Malay and Chinese journals are especially written with that purpose in view and in the supply of suitable articles, the Department of Agriculture has received valuable support from other departments; notably, the Rubber Research Institute of Malaya and the Co-operative Department.

## Leave.

Mr. W. N. C. Belgrave, Plant Physiologist, returned from leave of absence on the 10th March, 1930.

Dr. H. W. Jack, Economic Botanist, returned from leave of absence on the 20th March, 1930.

# DEPARTMENTAL NOTES.
## FROM THE DISTRICTS.

### The Weather.

The spell of drought broke definitely during the month. In the central portion of the Peninsula, rain came in the form of occasional and rather local showers and thunderstorms. In the north, there were heavy showers and thundersorms on most evenings after the middle of the month, while on the east coast of Pahang and in the south the first half of the month was generally wet.

### Remarks on Crops.

*Rubber.*—By the end of the month, wintering had practically finished and the young foliage was developing. The showers which fell were sufficient to assist leaf development, but, except in Larut district, did not cause any noteworthy increase in diseases, such as Mouldy Rot which remained little in evidence. Outbreaks of secondary leaf fall caused by *Oidium heveae* were, however, recorded from certain localities in Negri Sembilan and Malacca.

In Pahang West, the effect of wintering and the long drought have decreased yields to such an extent that in some areas tapping has had to be stopped. It was estimated that in Singapore Island, at least half of the rubber trees were not being tapped. Excessive tapping appears to be prevalent on small holdings in Selangor. Very fair smoked sheet is being produced by small-holders in certain mukims around Pekan in eastern Pahang.

*Padi.*—Harvest was practically completed in all districts, except Province Wellesley South, Krian, Lower Perak, the coastal mukims of Kuala Selangor, the coastal mukims of Pahang and the Northern district of Malacca around Alor Gajah.

In Temerloh district, Pahang West, planting of nurseries was scheduled to commence during February, but this operation was prevented by drought. It is to be hoped that rain will fall soon, as early planting is essential in the river mukims of this district if the harvest is to be reaped before the flood season commences. In Pahang East, preparation of land was in progress in the mukims along the Pahang river and nurseries were just being sown.

The comparative failure of the padi crop in Kedah and in the Settlement of Penang has not been attended by a rise in the local price of padi, the price, at 11 to 12 cents per gantang, being actually lower than that realised in the last two seasons.

*Tea.*—In addition to the 5,750 acres already alienated near Camerons Highlands, a further 3,297 acres in this neighbourhood is under approved application, but the terms have not yet been accepted by the applicants. The crops to be grown include tea, Arabian coffee, cardamoms cinchona, vegetables and fruits.

*Pineapples.*—In Singapore prospects of a good crop appear very favourable. During the month, the young pines made considerable progress, probably owing

to the good rains in the first half of the month. Canning factories recommenced operations in the second half of the month when small quantities of early fruit were received, mostly from Johore.

*Food Crops.*—In Pahang West large areas of maize and to a less extent of tapioca and sugar cane are being planted in many of the river mukims where rice supplies are short. State Land along the river banks is being cleared on Temporary Occupation Licence. Similar measures are being undertaken in parts of Kedah where the rice crop has failed.

*Fruit.*—In Pahang East, duku, rambai, pomelo, mango and lime were fruiting.

## Live Stock.

An area of over 14 acres of land within 1½ miles of Teluk Anson has been granted on a 15 year lease for the purpose of establishing a dairy, from which milk and live stock will be sold in the town.

## Exhibition for Tourists.

On March 2nd and 6th a small exhibition was put up in Malacca for passengers from tourist ships. This included padi and the implements used in its cultivation, oil palms, coconuts, Malayan pineapples, kapok and collections of local fruit and vegetables. The visitors were much interested in the exhibits and a number of enquiries were made with regard to the major crops.

## Work in Conjunction with the Co-operative Department.

A lecture on banana cultivation was prepared by the Agricultural Field Officer, Perak South, and delivered by the Junior Agricultural Assistant, Kinta, to a meeting of the Tronoh Co-operative Credit Society. It was attended with interest by thirty-two Malays who at the completion of the lecture brought up a few of their agricultural problems.

## Notes on Demonstration Stations and Padi Test Plots.

*Poultry Station, Kuala Kangsar.*—The first settings of eggs incubated at this station gave a very high proportion of failures. It was thought that many of the eggs were infertile, but it has since been found that this is not the only cause of the failure. The matter is being investigated.

*Seremban Demonstration Station.*—Harvesting of Salisbury White Sweet Corn was started, the seed obtained will be distributed to school gardens. Greater yam No. 30 was also harvested and is being multiplied for distribution.

*Kuala Lipis Demonstration Stations.*—A few of the orange trees planted at the end of 1927 commenced to bear fruit. The food crop plots were harvested and a considerable quantity of planting material including maize, groundnuts, cowpea, soya bean, sweet potato and red gourd is available for distribution to

school gardens. Eight varieties of cover crop and green manure plants were planted during the month.

*Pekan Demonstration Station.*—Two new bullocks were purchased and broken to plough. Marcots of lemon, lime and chiku are now available. Plants distributed included bananas, yams, dwarf coconuts, tebu bertelor and packets of various vegetable seeds, including tomato.

Considerable progress was made in the selection of sites for additional demonstration stations and padi test plots in most States and Settlements.

## School Gardens.

Regular inspections of school gardens were carried out in all parts of the country. Most of the schools remained closed for the holidays until about the middle of the month. In the majority, therefore, the beds were being dug over and replanted. Some have been given careful attention during the absence of the scholars, but a number of others have been badly neglected and will require considerable attention. In many instances more use should be made of local vegetation or neighbouring supplies of cattle manure for improving the soil, while compost heaps for supplying humus are still needed in a number of gardens.

In Malacca, the Inspector of Schools and the Agricultural Field Officer scrutinised the marks given to the schools for their gardens for the year 1929. Kesang Tua and Brisu were placed top together and Pengkalan Baluk third. The standard generally was high and the marks very close.

## Rats.

In Krian, the rat campaign was continued and 6,871 tails were collected. In Province Wellesley, the campaign accounted for 76,489 rats, the majority of which were young rats taken from nests in the "batas" of padi fields and brought in by Tamil coolies. Poison baits distributed amounted to 4,800. Little or no rat damage has been reported.

In Malacca, work was confined to destruction of rats in the "batas" of padi fields. Where flooding had resulted from recent showers no rats were found.

# MARKET PRICES.

## MARCH, 1930.

*Rubber.*—The average London price for rubber in March, 1930 was 7.6 pence per lb. being a fall of .3 pence over the previous month. The price varied very slightly throughout the period. The average Singapore price was 25.43 cents per lb. compared with 26.25 cents in February. The fluctuation was between 26 cents and 24¼ cents per lb.

*Copra.*—Singapore prices for copra shew a further decline, recovering somewhat at the end of the month. Average prices per picul of 133⅓ lbs. F.M. $8.54 against $8.84 in February; S.D. $8.90 against $9.31 in February. The Singapore Chamber of Commerce reports transaction amounting to 2327 tons for the period 24th February to 22nd March.

*Gambier.*—Singapore average prices: Bale $8.97 per picul, against $8.96 in February 49 tons being recorded; Cube Nos. 1 and 2 $15.71 against $15.50 for the previous month.

*Nutmegs.*—Average prices: 110 per lb., $35.50 per picul; 80 per lb., $38.75, against $43.20 and $44.80 respectively for February.

*Pepper.*—Black; $47.31 per picul against $50½ in February, 109 tons being recorded; White Sarawak, $67.34—130 tons, against the February average price of $75 per picul.

*Rice.*—Siam rice rose in price from $331 per coyan to $352—average $339.50; Saigon, white fluctuated between $244 and $250—average $247; Rangoon, white appreciated in price from $215 to $235—average $222 per coyan. The average prices per coyan for February were $384.60, $253.80, $239.60, respectively.

*Sago.*—Singapore average prices: Pearl, Fair $7.03 per picul, 105 tons against $7.20 in February; Flour $3.92 per picul, 1072 tons being recorded, compared with $4.20 per picul in February.

*Tapioca.*—Average prices in Singapore; Flake small, fair, $5.57, (920 tons) against $5.84 per picul in February; Pearl, fair, $7.47 per picul (166 tons) compared with $7.95 in February.

The above market prices are based on the daily cabled London quotations for rubber and on the Singapore Chamber of Commerce Market Reports covering the period 24th February to 22nd March, 1930, and from other local sources.

1 Coyan = 40 piculs    1 picul = 133⅓ lbs.

The dollar has been fixed at 2 shillings and 4 pence.

# MALAYA RUBBER STATISTICS.

**Stocks of Rubber including Latex and Revertex held by Dealers and Estates of 100 Acres and over, together with the Declared Production of the same Estates, Import and Export Figures, and Estimated Figures of the Production of Estates of Less than 100 Acres, for the Month of February, 1930, in Dry Tons.**

| Territory | Stocks at beginning of month | | | Production by estates of 100 acres and over | | Production by estates of less than 100 acres (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | during the month | | during the year 1930 | | during the month | | during the year 1930 | | | | |
| | Ports | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | Foreign | From Malay States | Foreign | From Malay States | Foreign | Local | Foreign | Local | Dealers | Estates of 100 acres and over | Ports |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **Malay States** | | | | | | | | | | | | | | | | | | |
| Federated Malay States ... ... | ... | 11,753 | 16,226 | 11,112 | 24,677 | 11,248 | 22,820 | Nil | 7 | Nil | 16 | 17,999 | 6,078 | 35,267 | 12,681 | 11,941 | 14,338 | |
| Johore ... ... | ... | 2,172 | 5,494 | 3,399 | 7,363 | 4,471 | 9,051 | Nil | Nil | Nil | Nil | 1,069 | 7,048 | 1,932 | 15,010 | 2,379 | 5,040 | |
| Kedah ... ... | ... | 537 | 2,247 | 1,751 | 3,946 | 1,408 | 3,085 | 1 | Nil | 2 | Nil | 813 | 2,894 | 1,584 | 5,965 | 359 | 1,878 | |
| Perlis ... ... | ... | 21 | 7 | 8 | 18 | 22 | 34 | Nil | Nil | Nil | Nil | Nil | 21 | Nil | 47 | 28 | 9 | |
| Kelantan ... ... | † | — | — | — | — | — | | 6 | Nil | 9 | Nil | 64 | 718 | 135 | 1,357 | | | |
| Trengganu ... | | | | | | | — | Nil | Nil | Nil | Nil | Nil | 153 | Nil | 345 | | | |
| **Straits Settlements** | | | | | | | | | | | | | | | | | | |
| Malacca ... ... | ... | 2,482 | 1,904 | 1,167 | 2,646 | | | Nil | 1,107 | Nil | 2,207 | 4,098 | | 8,747 | | 2,505 | 1,649 | |
| Province Wellesley | ... | 150 | 807 | 463 | 1,074 | | | | | | | | | | | 143 | 638 | |
| Dindings ... ... | ... | 47 | 163 | 93 | 200 | * | — | 1,059 | 3,732 | 1,938 | 7,783 | 6,640 | Nil | 12,628 | Nil | 94 | 147 | |
| Penang ... ... | 1,834 | 4,977 | 19 | 8 | 21 | | | | | | | | | | | 5,377 | 7 | 1,859 |
| Singapore ... ... | 4,425 | 27,875 | 411 | 243 | 517 | | | 9,306 | 12,068 | 18,375 | 25,406 | 20,170 | | 41,478 | | 31,214 | 410 | 4,962 |

**Analysis of Colony and Federated Malay States Dealers, Stocks at End of Month, in Dry Tons.**

| Class of Rubber (20) | Federated Malay States (21) | Singapore (22) | Penang (23) | Province Wellesley Dindings and Malacca (24) | Johore (25) | Kedah (26) | Gross total (27) |
|---|---|---|---|---|---|---|---|
| Smoked sheet ... | 8,709 | 11,912 | 3,545 | 1,489 | | | 25,655 |
| Crepe ... ... | 726 | 15,683 | 909 | 618 | — | — | 17,936 |
| Unsmoked sheet ... | 1,230 | 3,619 | 923 | 635 | | | 7,683 |
| Scrap and lump ... | 1,276 | | | | | | |
| Total all Grades ... | 11,941 | 31,214 | 5,377 | 2,742 | 2,379 | 359 | 54,012 |

*Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

*2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10). The formula is not applied, for the present, to the Straits Settlements, owing to the uncertainty of the true weight of foreign imports. No estimate, therefore, is made of domestic production.

3. Colony Dealers' stocks are as published in Return I. & E. 6, dated March 11. The ratio of the reduction on wet rubber, taken from dealers' return, is 21.8% for Singapore and 16.5% for Penang (*S.S. Gazette* Notification No. 508/1930). The ratios for January should read as 28 and 10%.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%.

5. Foreign imports are as published in Return I. & E. 5, dated March 7, reduced to dry weight by the percentages in Note 3 (*S.S. Gazette* Notification No. 506/1930).

6. Foreign exports are those of each State and Settlement as published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments of published in Return I. & E. 4, dated March 7 (*S.S. Gazette* Notification No. 507/1930).

† 7. The States of Kelantan and Trengganu have no organisation at present for the collection of returns of stocks and production, the latter can be estimated as equivalent to exports.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals. The latest publication is therefore always the most reliable.

Kuala Lumpur,
*March, 1930.*

J. Gordon-Carrie,
*for Acting Registrar-General of Statistics, S.S. and F.M.S.*

# METEOROLOGICAL SUMMARY, MALAYA

## JANUARY, 1930.

| Locality | Air Temperature in degrees Fahrenheit: Means of A. Max. | Means of B. Min. | Mean of A and B | Absolute Extremes: Highest Max. | Date. | Lowest Min. | Date | Lowest Max. | Date | Highest Min. | Date | Earth Temperature: At 1 foot | At 4 feet | Rainfall: Total | Total | Most in a day: Amt. | Date | Number of Days: Precipitation | Precipitation, 1mm. or more | Thunderstorm | Thunder heard | Fog morning obs. | Bright Sunshine: Total | Daily Mean | Length of Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | °F | °F | | °F | | °F | | °F | | °F | °F | in. | mm. | in. | | | | | | | hr. | hr. | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 92,6 | 71,9 | 82,2 | 95 | 15th | 67 | 9th | 78 | 7th | 73 | — | 82,9 | 83,1 | 8,41 | 213,36 | 2,90 | 16th | 17 | 13 | 2 | 15 | ... | 206,75 | 6,67 | |
| Bukit Jeram, Selangor ... | 90,9 | 71,9 | 81,4 | 91 | 17th | 69 | 19th | 83 | 7th | 74 | 26th | 83,9 | 85,3 | 5,09 | 129,3 | 1,60 | 6th | 14 | 10 | ... | 22 | 1 | 234,65 | 7,86 | |
| Temerloh, Pahang ... | 90,7 | 70,5 | 80,6 | 93 | 28th | 67 | 30th | 74 | 7th | 73 | Several | 83,1 | 83,7 | 2,03 | 51,57 | ,77 | 12th | 10 | 8 | 1 | 4 | 10 | 226,25 | 7,30 | |
| Kuala Lipis, Pahang ... | 88,4 | 71,1 | 79,7 | 90 | Several | 68 | 2nd, & 7th | 74 | 7th | 73 | 26th | 81,2 | 81,4 | 6,18 | 156,98 | 3,49 | 28th | 14 | 4 | 2 | 7 | 8 | 200,15 | 6,46 | |
| Kuala Pahang, Pahang ... | 85,3 | 75,2 | 80,3 | 85 | „ | 70 | 7th | 75 | 7th | 79 | 29th | 81,0 | 82,7 | 16,17 | 410,7 | 5,43 | 6th | 19 | 17 | ... | ... | ... | 193,85 | 6,25 | |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 72,6 | 58,4 | 65,5 | 73 | 10, 18 & 25th | 56 | 6th | 63 | 7th | 60 | Several | ... | ... | 5,71 | 144,9 | 0,84 | 16th | 18 | 12 | ... | 7 | 3 | 139,90 | 4,51 | |
| Cameron's Highlands, Tanah Rata ... | 72,6 | 53,9 | 63,2 | 73 | Several | 48 | 30th | 65 | 7th | 61 | 23rd | 67,6 | 68,6 | 6,40 | 162,5 | 1,20 | 21st | 19 | 12 | ... | 7 | ... | 133,60 | 4,31 | |
| Fraser's Hill, Pahang ... | 71,7 | 60,8 | 66,3 | 74 | 25th | 58 | Several | 60 | 7th | 64 | 26th | 69,9 | 70,1 | 6,68 | ... | 1,26 | 11th | 19 | 16 | 2 | 13 | 26 | 143,50 | 4,63 | |
| Mount Faber, Singapore ... | 88,5 | 71,9 | 80,2 | 90 | 26th | 70 | 30th | 76 | 6th | 73 | Several | 79,2 | 80,7 | 4,07 | ... | 0,83 | 15th | 17 | 12 | 2 | 8 | ... | 195,60 | 6,31 | |
| Bukit China, Malacca ... | 89,4 | 73,5 | 81,5 | 91 | Several | 71 | Several | 81 | 8th | 76 | 26th | 83,1 | 83,7 | 1,23 | 31,25 | 0,46 | 21st | 10 | 4 | 1 | 5 | 1 | 252,95 | 8,16 | 11,30 |
| Kluang, Johore ... | 88,6 | 71,4 | 80,0 | 89 | 1, 27 & 28th | 69 | 30th | 73 | 7th | 73 | Several | 79,2 | 80,5 | 5,32 | 135,1 | 2,67 | 9th | 12 | 11 | ... | 2 | 2 | 212,25 | 6,84 | 10,85 |
| Bukit Lalang, Mersing, Johore ... | 84,3 | 73,0 | 78,7 | 85 | Several | 69 | 21st | 75 | 6th | 77 | „ | 78,9 | 79,3 | 11,84 | 300,7 | 4,00 | 5th | ... | ... | ... | 1 | 1 | 218,05 | 7,03 | |
| Alor Star, Kedah ... | 93,8 | 70,8 | 82,3 | 95 | 22nd & 29th | 68 | 15th & 22nd | 88 | 1st | 73 | 13th & 28th | 83,7 | 84,9 | 0,46 | 11,68 | ,21 | 1st | 3 | .. | ... | 3 | ... | 291,25 | 9,40 | |
| Kota Bharu, Kelantan ... | 86,0 | 69,8 | 77,9 | 86 | Several | 68 | Several | 84 | Several | 74 | 13th | 81,5 | 82,4 | 2,61 | 66,30 | ,46 | 11th | 18 | 16 | ... | ... | ... | 243,15 | 7,84 | |
| Kuala Trengganu, Trengganu ... | 85,0 | 70,9 | 77,9 | 85 | 1, 17 & 18th | 67 | 20th | 78 | 11th | 77 | 24th | 80,4 | 81,1 | 7,47 | 189,75 | 1,80 | 11th | 20 | 18 | ... | ... | 3 | 230,85 | 7,45 | |

Compiled from Returns supplied by the Meteorological Branch, Malaya.

# METEOROLOGICAL SUMMARY, MALAYA.

## FEBRUARY, 1930.

| Locality | Air Temperature in degrees Fahrenheit: Means of A. Max. | Means of B. Min. | Mean of A and B | Absolute Extremes: Highest Max. | Date | Lowest Min. | Date | Lowest Max. | Date | Highest Min. | Date | Earth Temperature: At 1 foot | At 4 feet | Rainfall: Total | Total | Most in a day: Amt. | Date | Number of Days: Precipitation | Precipitation, 1mm. or more | Thunderstorm | Thunder heard | Fog morning obs. | Bright Sunshine: Total | Daily Mean | Length of Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | °F | °F | | °F | | °F | | °F | | °F | °F | in. | mm. | in. | | | | | | | hr. | hr. | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 90,6 | 71,2 | 80,9 | 96 | 26th | 69 | 1st | 88 | 8th | 75 | 27th | 83,8 | 83,9 | 3,57 | 90,69 | 1,20 | 9th | 8 | 7 | ... | 2 | ... | 232,80 | 8,52 | |
| Bukit Jeram, Selangor ... | 88,4 | 71,3 | 79,9 | 94 | 23, 27 | 70 | Several | 89 | Several | 74 | Several | 87,3 | 87,3 | 0,18 | 4,6 | 0,13 | 8th | 2 | 2 | ... | 12 | ... | 267,45 | 9,55 | |
| Temerloh, Pahang ... | 88,0 | 70,8 | 79,4 | 95 | Several | 68 | " | 83 | 16th | 75 | 26th | 84,7 | 84,7 | 1,53 | 38,87 | 1,22 | 8th | 5 | 4 | 1 | 2 | 7 | 218,40 | 7,80 | |
| Kuala Lipis, Pahang ... | 86,8 | 70,2 | 78,5 | 93 | 25th | 69 | 20, 21 | 83 | 16th | 73 | Several | 82,2 | 81,9 | 3,43 | 87,13 | 1,45 | 9th | 11 | 8 | 2 | 3 | 9 | 200,15 | 7,15 | |
| Kuala Pahang, Pahang ... | 82,9 | 74,1 | 78,5 | 87 | Several | 70 | 16th | 81 | 16th | 79 | " | 85,0 | 84,9 | 1,78 | 45,22 | 0,78 | 16th | 9 | 5 | ... | ... | ... | 235,65 | 8,4 2 | |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 70,6 | 59,3 | 64,9 | 79 | 5th | 56 | 20th | 67 | 15th | 60 | " | ... | ... | 0,64 | 16,4 | 0,37 | 8th | 8 | 2 | ... | 7 | 3 | 180,40 | 6,44 | |
| Cameron's Highlands, Tanah Rata ... | 70,8 | 55,7 | 63,3 | 76 | 5, 28 | 46 | 23rd | 69 | 15, 17 | 60 | " | 68,1 | 68,3 | 0,90 | 22,86 | 0,50 | 8th | 9 | 3 | ... | 7 | ... | 173,35 | 6,19 | |
| Fraser's Hill, Pahang ... | 70,0 | 60,4 | 65,2 | 75 | Several | 58 | 15th | 68 | 17th | 63 | " | 71,0 | 71,0 | 2,23 | 56,65 | 0,72 | 16th | 12 | 11 | 1 | 8 | 22 | 168,05 | 6,00 | |
| Mount Faber, Singapore ... | 86,4 | 72,2 | 79,3 | 91 | 7, 25 | 70 | Several | 85 | 8th | 74 | 27th | 81,0 | 82,0 | 3,12 | 79,26 | 1,23 | 9th | 6 | 5 | 2 | 4 | ... | 235,0 | 8,39 | |
| Bukit China, Malacca ... | 80,0 | 76,0 | 82,0 | 93 | 6th | 71 | 16th | 84 | 8, 26 | 76 | 27th | 84,6 | 84,8 | 3,28 | 83,33 | 1,70 | 10th | 4 | 4 | ... | 6 | ... | 246,05 | 8,79 | 11,35 |
| Kluang, Johore ... | 85,8 | 71,4 | 78,6 | 94 | 25th | 68 | Several | 83 | 17th | 73 | Several | 80,8 | 81,3 | 1,37 | 34,8 | 0,61 | 16th | 6 | 5 | ... | 2 | 2 | 233,60 | 8,34 | |
| Bukit Lalang, Mersing, Johore ... | 82,7 | 74,0 | 78,3 | 86 | 28th | 68 | " | 82 | 17th | 78 | 14, 24 | 78,1 | 79,6 | 1,99 | 50,6 | 0,89 | 17th | ... | ... | ... | 1 | ... | 263,55 | 9,41 | |
| Alor Star, Kedah ... | 92,0 | 70,3 | 81,1 | 98 | 22nd | 67 | 21st | 89 | Several | 75 | 3rd | 85,2 | 85,7 | 0,45 | 11,43 | 0,25 | 3rd | 4 | ... | .. | 11 | .. | 260,80 | 9,31 | |
| Kota Bharu, Kelantan ... | 85,0 | 71,2 | 78,1 | 89 | 9th | 65 | 6th | 83 | " | 74 | 17, 18 | 81,7 | 82,4 | 2,08 | 52,84 | 1,18 | 15th | 4 | 4 | ... | ... | .. | 249,95 | 8,93 | |
| Kuala Trengganu, Trengganu ... | 83,7 | 71,3 | 77,5 | 88 | 26th | 65 | 6th | 83 | 16th | 75 | 18th | 81,5 | 82,0 | 1,60 | 40,65 | 1,08 | 15th | 11 | 7 | ... | .. | 3 | 258,10 | 9,22 | |

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

# Malayan Agricultural Journal.

Vol. XVIII. MAY 1930. No. 5.



## ORIGINAL ARTICLES.



## SELECTED ARTICLE.



## REVIEWS.



## MISCELLANEOUS.

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The Director, Rubber Research Institute.
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**The Malayan Agricultural Journal.**

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The Agricultural Economist.
The Agricultural Chemist.
The Entomologist.
The Chief Agricultural Field Officer.
The Assistant Chemist for Copra Investigations (Secretary).

THE

# Malayan Agricultural Journal

MAY 1930.

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## MESSAGE TO THE MALAYAN AGRICULTURAL JOURNAL

FROM

**His Excellency, Sir Cecil Clementi, K.C.M.G.,**

*Governor and Commander-in-Chief of the Straits Settlements and High Commissioner for the Malay States.*

His Majesty the King, on the occasion of his visit to the International Institute of Agriculture at Rome in 1923, said of agriculture that it " provides " not only the actual necessities of life, but a firm foundation of social and " political stability, while ensuring to a thrifty and industrious population a " life under the healthiest of natural conditions." The aim of the King's Government in all parts of His Majesty's Dominions is the welfare of his subjects—men, women and children—and the creation of happy, healthy and prosperous homes. Now, in order that this aim may be attained, there must in the first place be provision for the actual necessities of life, and foremost among these is food. The staple food of the great mass of those who inhabit Malaya is rice. Therefore, the earth must yield her increase, if all inhabitants of Malaya are to be well fed. But the Peninsula, as sad experience has shown in the past, is far from self-supporting in the matter of its rice supply. *The Malayan Agricultural Journal* for last month shows that only 32½% of the rice consumed in Malaya last year was produced in Malaya. Worse than that the local production of rice, which in 1921 was 254,538 tons had decreased to no more than 180,328 tons in 1929. Last year we imported 555,539 tons of rice, a larger quantity than ever before, and paid for it $57,911,429, a sum which might have gone to enrich Malaya itself, had we grown the rice locally. I know that the Malay Rulers have shown the closest personal interest in stimulating their people to grow more rice. Nevertheless the position continues to be unsatisfactory. Greater attention to control of water both in the matter of drainage and of irrigation is necessary. Careful attention must also be paid to manuring the land and to the planting of suitable strains of improved seed. Above all, there

must be unceasing industry on the part of the cultivators, otherwise there can be no real progress. Very great efforts have been, and are being made in this country to promote the cultivation of rubber, coconuts and oil palms; but the time has now come when more attention should be paid to rice cultivation as well as to pastoral industries, in order that the staple food of the people may be made available locally. Large undeveloped areas in this country still lie idle, with abundant water supply, suitable for producing rice crops; and I hope that this century may witness in Malaya both extensive development of the rice industry and effective establishment of pastoral industries. Nothing could do more to provide the actual necessities of life and to settle the population of this country, in the King's phrase, "on a firm foundation of social and political stability."

*Governor of the Straits Settlements*
*and*
*High Commissioner for the Malay States.*

*Singapore,*
*Government House,*
*8th April, 1930.*

## EDITORIAL.

With the lapse of time, the interest which centres in the organisation of agricultural research and extension work in the tropics continues steadily to augment.

**The Organisation and Work of the Department of Agriculture.**

In the Crown Colonies and Protectorates, the impetus given to the question by the report of the Lovatt Committee on the staffing of Colonial Agricultural Departments, the recommendations of the Colonial Conference of 1926, the report on the same question by the Colonial Office Committee in that year and the recommendations of the Imperial Agricultural Research Conference 1927, has caused attention to be focussed on the problems of the organisation of agricultural research in the tropics and the dissemination of information from such research in a manner which has never before occurred.

On parallel, through distinct lines, is the report of the Royal Commission on Agriculture in India, presided over by Lord Linlithgow, which was issued in 1928, while the latest addition to the series of reports and recommendations for the better organisation of tropical agriculture is that of the East African Commission presided over by Sir A. D. Hall which is reviewed elsewhere in the current issue of *The Malayan Agricultural Journal.*

Ideas on the organising of agricultural research and investigation have gained enormously in importance and in precision during the past decade. It may now be safely said as a result of the attention which has been devoted to the subject and the numerous discussions which have taken place concerning its various aspects, that ideas of competent thinkers on the methods which should be employed both in the organisation of research in the tropics and the dissemination of information are becoming very clearly crystallised and standardised throughout. It is now important that the trend of these ideas should also become clearly apprehended both by the various Governments concerned and by the agricultural communities which they are intended to benefit, inasmuch as concentrated study of a problem which affects the welfare of communities can be of little avail if the conclusions arrived at are not fully understood.

It may, perhaps, be pointed out here that it is now generally accepted that quite as much attention is required to the extensional services, i.e. those which are connected with the dissemination of information, as to the conduct of research work itself, and it is essential that definite channels should be established by which the results of the research workers can flow to the different sections of the community. This is accomplished by personal contact, by demonstrations, by cinema films, by exhibits and by the printed word. One

of the most important steps consists in the establishment of local demonstration and test stations where the results obtained by research work can be demonstrated in the field to cultivators.

Moreover, in order to achieve uniformity of aim and complete understanding among workers, frequent contacts between those engaged both in research and extension work in different centres of activity are essential and this is best provided for by the holding of periodic conferences. The importance of such conferences is stressed by all authorities.

Recently, Mr. F. A. Stockdale, Agricultural Adviser to the Colonial Office, paid an official visit to the West African Colonies and in the course of that visit attended the West African Agricultural Conference organised by the various West African Governments and attended by delegates from the Agricultural Departments of each Colony. It would appear from information recently to hand that the conference proved its value in co-ordinating and unifying work and avoiding overlapping.

A proposal for organising similar conferences in the Far East was put forward at the Pacific Science Congress held in Java in May, 1929. It is hoped that the proposal will ultimately be realised, inasmuch as in this extended field of work, gatherings of this description can prove of great value.

**Manuring of Rubber.**

To this number of the Journal, an important review of the present position in relation to the manuring of rubber is contributed by Dr. W. B. Haines, Head of the Soils Division of the Rubber Research Institute of Malaya.

There is probably no subject in the whole range of tropical and temperate agriculture which has been productive of more diverse results and more acute controversy than the question of manuring rubber. It seems, however, not unlikely that a great deal of the diversity of opinion which has been and is still expressed on this important subject may be due to lack of understanding of the position.

Everybody realises that, in general, it is impossible to continue for an indefinite period, the removal of crops from an area of land without recourse to measures of restoring the elements of fertility which are removed.

It is not, however, so generally realised that the problem in relation to rubber cultivation is a very specialised one and differs in its general and practical aspects from the manuring of crops such as rice, coconuts, tea, coffee, sugar or tapioca, inasmuch as in all these crops the annual toll of plant food removed by the crop itself is considerable and if continued cropping is resorted to without restoration of plant food to compensate for what is removed by the crop, soil exhaustion will normally set in.

With rubber the case is otherwise. The actual amount of plant food removed from the land in the act of taking off a crop of latex is, to all intents, negligible; consequently, the problem of manuring rubber does not comprise the restoration of plant food removed by the crop, but rather the maintenance

of fertility by guarding against losses which may occur by other means and particularly in supplying deficiencies which have arisen, either owing to natural deficiencies, to accidental losses, e.g. by wash, or as the result of the previous cropping of the land which has led to the exhaustion of plant nutrients. Particular interest attaches to Dr. Haines' observations concerning the possibility of finding some stimulant which when applied to the soil may, through some physiological action, increase the flow of latex. It may be said, in fact, that the manuring of rubber in its present aspects opens up a series of questions in relation to crop husbandry which have so far not assumed prominence in connection with other crops.

In the Editorial of the February issue of this Journal, attention was directed to the position of the Malayan pineapple growing industry.

**Cultivation of Pineapples.**

In the present number, Mr. Grist contributes an article in which methods of cultivating pineapple as practised in Malaya, in Hawaii and in South Africa are contrasted and compared; this comparison should afford food for thought to those who are interested in the industry and may serve to attract the attention of those who at present are not so interested but who may be induced to give the matter their consideration as a planting proposition.

There seems to be little doubt that, on natural grounds, Malaya offers a field for the exploitation of this type of cultivation which is unsurpassed by any other region in the world; consequently it is of importance to ascertain how far Malayan standards of cultivation compare with those practised in other producing centres and to what extent the industry, which is at present entirely carried on as a catch crop, may be capable of being placed on a more permanent footing. In the consideration of these questions, economic factors must of course largely enter.

The Hawaiian pineapple industry enjoys the advantage of a protection in the market of the United States; this security is not at present shared by the Malayan and South African industries in the English market.

A necessary adjunct to improving on the cultivation of pineapples as a major crop is information concerning the manurial requirements of the plant and the toll which the cultivation may be expected to take from the soil, and it is of interest here to record that the Department of Agriculture is at present considering the establishment of an experiment station for the investigation of problems connected with the cultivation and manuring of the pineapple crop in the Island of Singapore.

In a subsequent article, Mr. Grist will review and compare manufacturing methods as they exist in the three countries under consideration and will summarise the world production of canned pineapples. With the publication of this information, growers in Malaya will be placed in a position of being able to see clearly for themselves how the local industry compares with practice obtaining in other countries.

# THE ECONOMICS OF THE RICE SITUATION.*

BY

H. A. TEMPANY,

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The rice situation is of great importance to Malaya, and, on account of the fact that the country is largely dependent on imports of this commodity, close and constant watch should be kept to guard against any possible shortage of supplies. Malacca has for some time past taken a keen interest in rice production for which reason it is considered to be a suitable centre for an exposition of some of the economic factors affecting the production of rice.

There are two schools of thought on the subject of rice production in Malaya. One holds that rice production should be encouraged by all possible means so as to reduce dependence on outside sources of supply. The other maintains that agricultural prosperity has been built on a foundation of exports of other staples and that while rice cultivation should be maintained at its existing level and encouraged by all reasonable means, large scale expenditure and effort with a view to encouraging greatly increased production are to be deprecated inasmuch as they may lead to a nett loss of prosperity. No doubt the latter view seems at first sight to have been justified by results in the past. Malaya has risen to an extraordinary height of prosperity apparently as a result of it, but the matter is due for re-consideration as it is by no means certain that the conditions of the past will be continued in the future. In fact, the question of future policy in this respect will depend on the future of rubber and of other products of Malaya and the manner in which their economic position reacts on the purchasing power of the Asiatics. Malaya is essentially a rice consuming country and it may surprise some to know that the *per capita* rice consumption is higher in this country than in any other in the world.

In view of the fact that the purchasing power of this country for rice depends upon the production of other commodities, we may forget for a minute that money is the medium of exchange and take as a basis the purchasing power of one staple in terms of another. In the accompanying graph is shown therefore the purchasing power of 1 lb. of rubber in terms of lbs. of rice. This throws some valuable sidelights on the situation, e.g., it transpires that the economic situation at present is practically the same as it was in 1920 or 1921; in 1920, a high price of rubber was balanced by a high price for rice; in 1921, both prices dropped, leaving the relative economic position unaltered.

* The following is an abstract of the main points in a lecture on the above subject delivered by the Director of Agriculture before the Malacca Planters' Association on 9th March, 1930.

The present average yield of rubber for the Malay Peninsula is approximately 400 lbs. per acre, while the average yield of cleaned rice is 600 lbs. per acre, so that even at present prices, rubber is probably rather more profitable to produce than is rice.

But in reality, the position is not as stable as one might believe from the above-mentioned facts. The factors which may affect the future relative position of these two crops are as follows:—the price of rice may rise; small-holders' rubber yields may drop; rice producing conditions in Malaya may improve; rubber prices may still further decline. Malaya has not yet experienced the conditions which will result when a high price for rice coincides with a low price for rubber.

With reference to the possibility of improvement in the rice producing conditions it may be mentioned that such improvement is very possible by improved irrigation facilities, by better cultivation and manuring and by the use of improved strains of seed. With a higher yield of rice the economic position would materially change.

A further examination of the rice situation reveals the following facts—local production is steady, imports and consumption are steadily increasing and there is no tendency to substitute other grains for rice as is the case in the Philippine Islands, Java and Japan.

No marked increase in area under rice in Malaya can be expected under present circumstances; unless better facilities for cultivating the crop are provided. The work of the Department of Agriculture, which has already shewn favourable results, has been mainly directed to seed selection. Improvement of crops through better irrigation has been effected in a few districts on a small scale. The question of manuring awaits solution, but there is little doubt that some such system is necessary and its application would tend still further to improve the lot of the rice cultivator.

A comparison of the rice position in Malaya and that obtaining in other neighbouring countries is instructive. There are two very definite divisions, viz., rice importing countries and rice exporting countries. In the former division there are two groups—the first British i.e., Malaya and Ceylon which rely for the majority of their rice supply on imports balanced by an export trade in other commodities;—the second, American, Dutch and Japanese which rely on developing domestic production.

The three large exporting countries are British India (which supplies about 50% of the exports), Siam and Indo-China. The exporting countries have a nett available surplus for export of about 4,350,000 tons. The present tendency is for exports to remain steady and for imports to increase. It is probable, therefore, that unless efforts are made to relieve the present growing demand by increasing the area under cultivation or the crop per acre, or both, or by encouraging the use of other foodstuffs to replace a part of the rice demand, the price of rice will show a continued upward tendency which will not be balanced by prosperity in other agricultural industries.

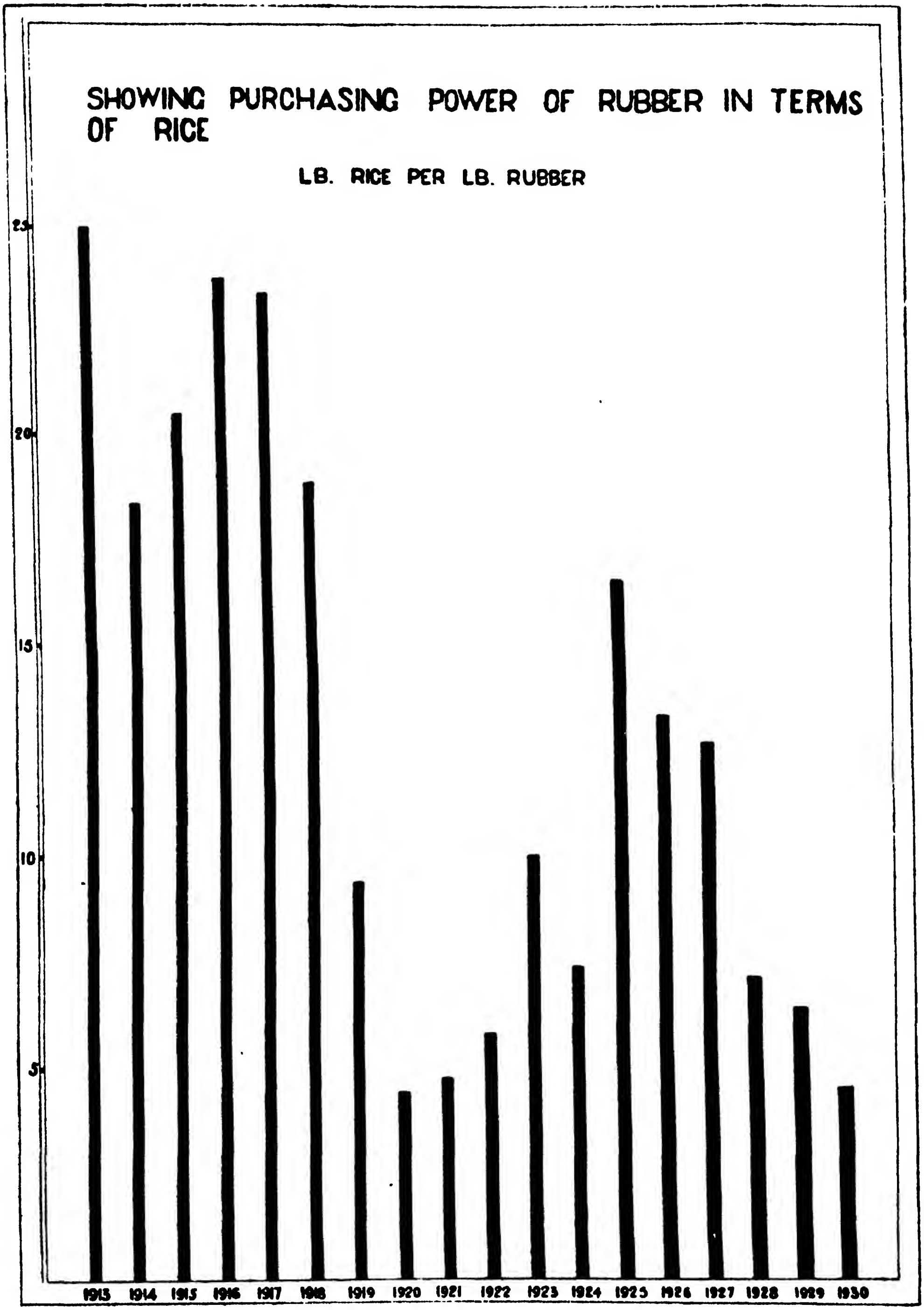
In passing it may be pointed out that the influence of China on the rice situation is unique. When prices are high, China's imports of rice are low, the quantity imported increasing with a decline in prices.

Regarding rice yields per acre, Japan has the highest of Eastern nations having risen perceptibly during the past 15 years; the Philippine Islands also shew a considerable rise; while Malaya, Ceylon and India remain stationary.

In the foregoing paragraphs, an attempt has been made to provide a succinct review of the rice situation so as to enable those interested to appreciate the main factors operating in a complex situation which profoundly affects the well-being of Malaya.

Taken in conjunction with the review of the rice situation in Malaya which appeared in the March issue of this Journal, it enables a fair estimate of the situation to be made and allows the probable course of future events to be envisaged.

It seems unlikely that Malaya can become entirely self-supporting in the matter of rice production at least for many years to come, but on the other hand, the existing situation whereby a rapidly increasing population remains unbalanced by any corresponding increase in the domestic food production, coupled with the facts that no marked increase in the world's available export excedent of rice can be expected; while the ever-present danger of temporary shortage owing to reduced crops in India appears to point conclusively to the need for the most careful consideration of measures calculated to increase the present domestic production of rice and other foodstuffs in Malaya beyond the dangerously low level which at present obtains.




The horizontal lines indicate the number of lbs. of rice which could be purchased for one lb. of rubber.

# MANURING OF RUBBER.

BY

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The last few years have seen a rapidly growing interest in Malaya in the use of artificial manures on rubber estates. This interest has arisen from two main sources: first, the very excellent results which have been reported from certain experiments in Sumatra, and secondly, from the growing realisation that large areas of rubber have passed their maximum yield and require measures to arrest deterioration. Since tapping has for many years now been conducted on a proper conservative basis, this deterioration can be attributed mainly to soil changes, and it is natural to turn to methods involving the use of chemical plant foods as stimulants.

## Special Features for Rubber.

In approaching the subject for a general discussion it is first of all necessary to realise the very sharp contrast between the conditions of rubber cultivation and those of temperate zone farming. Our knowledge of the effects of fertilisers has been mainly built up from experience with seasonal crops. These are grown under the best and most intensive conditions that soil cultivation will allow, and usually end in the removal of a large amount of plant food from the soil in the harvested crop. Manuring therefore aims at replacing these plant foods in such a way as to produce the maximum results on the crop during the ensuing season. Certain residues may be left after harvest, but the main return is always seen within the year. The case of a rubber plantation offers a very striking contrast to these conditions. The crop is not seasonal nor does it remove permanently any very appreciable quantities of plant foods. The natural cycle of changes are those of a forest in which a considerable proportion of the available food passes round a continuous cycle, from the soil to the tree, and from the tree back to the soil again in the form of leaf fall. The necessity for manuring arises, therefore, not so much from the necessity to renew losses taken away by the crop, as from needs caused by a break in the natural forest cycle. The open conditions fail to conserve the leaf fall and general humus reserve unless special measures are taken. The resulting effects are relatively slow and in consequence also the benefits from manuring are also likely to be slow. One cannot look forward to a full return within a year as the farmer does, but must await rather the restoration of a normal balance attained through several cycles of leaf development and leaf fall. The important assistance rendered by modern methods of soil conservation will be obvious, in that the cessation of surface wash and movement helps to retain the fallen leaves.

Another factor making for slow returns from manuring is that latex yield depends primarily on the bark condition of a tree, and this changes much more

slowly than the leaf canopy in response to the improvement in the conditions of nutrition. This brings into prominence another contrasting feature, namely, that the age and previous history of the crop are important factors to be considered, whereas the farmer may start anew each season with fresh seed. The rubber planter must consider deterioration of both his soil and his crop, while the farmer considers his soil only. This makes two distinct stages in recovery instead of one, and each stage conditioned by a very different set of factors.

As far as our present knowledge goes, the aim of manuring can only be the maintenance of a normal yield. So far there is no suggestion of specific manuring in the sense of stimulating latex secretion beyond the normal. Each tree must be regarded as having a normal potential yield, and, although this varies greatly from tree to tree, we do not yet expect to turn a natural bad yielder into a good yieldder by manuring. Growth under good conditions will give the normal yield, and if these conditions deteriorate it is possible to restore them and maintain yields by providing the necessary plant nutrients. A specific treatment which would greatly increase latex secretion may possibly be developed in the future through some discovery regarding the plant's physiology—at any rate, our knowledge is not extensive enough to rule out the possibility. But, such a discovery might be regarded as a doubtful gift for the scientist to make to an industry which has not yet solved its problem of over-production. At present, the question of increasing the *potential* yield of rubber per acre lies in the direction of perpetuating strains with an inherently high yield by methods of budding or breeding.

## Green Manuring and Cultivation.

The term "manuring" generally refers to the use of chemical fertilisers, but space must be devoted also to the mention of the value of green manuring for rubber estates. Green manuring has as its main object the provision of supplies of organic matter to the soil. It is possible that mineral plant foods may be rendered more available, since a coarse feeding cover might extract from the soil more food than the main crop could do, and this food is passed back in an available form when the cover dies or is turned into the soil. But the main function of the plant residues is to support the bacterial life of the soil, without which nitrogen fixation cannot go on. Another service that covers have performed in rubber is to break up the soil. The question of doing this by mechanical means is one that has naturally been viewed very conservatively by rubber planters. Under rubber cultivation there can be no doubt that some soil types tend to become consolidated in a way quite foreign to a forest soil, but the correction of this by mechanical means has serious objections on the grounds of root disturbance as well as expense. In such circumstances, a cover such as Mimosa has been known, by the vigorous penetration of its roots, to produce vastly improved conditions. The restoration of air and water movement to layers previously consolidated opens up fresh areas and supplies of plant food. But it must be remarked that in general, in Malaya, green manuring in old rubber has not promised much success. The part it may play in conjunction with

chemical fertilisers may be large, but that still remains to be worked out in detail. Green manuring will undoubtedly play a leading part in the work of reconditioning the soil in such areas as are marked down for re-planting, since the objections to mechanical soil disturbance are then quite removed, and conditions for growth of cover are vastly improved.

The use of organic fertilisers which add to the humus supply, such as cow dung or the artificial "Adco" product, is not here specially referred to. While their merits can scarcely be in question, they are nevertheless eclipsed by the chemical fertilisers on the question of adequate supplies for the large areas which are concerned.

## Mature Rubber.

Turning now to the special needs of mature rubber we find that areas requiring the help of fertilisers fall into two distinct classes. On the one hand we have rubber which was originally planted under favourable conditions and has given good results in the past, but which has begun to show signs of falling off. As we have seen, the reason for this deterioration lies mainly in the loss of humus and the cessation of nitrogen-fixing activities in the soil. The usual need in such cases is nitrogen. Fertilisers supplying this element are urea, sulphate of ammonia, sodium nitrate and calcium cyanamide. Of these, ammonium sulphate has proved the most popular, although cyanamide has also proved effective and may be of added service by supplying another important plant food, namely calcium. The signs of nitrogen starvation may be seen in the leaves. These are sparse, of small size and of an unnaturally light yellow-green colour. Manuring with nitrogen immediately produces an increase in foliage and a darkening in tint. The darker tint will often be observed in the location of dwellings where the trees receive extra nitrogen in the form of urea from human excreta. The improvement in foliage is not usually accompanied immediately by increase in latex yield.

The other distinct type of case is given when the soil has been exhausted by the cultivation of other crops previous to the planting of rubber. In such cases, in addition to the poverty of leaf, the growth is usually stunted and the bark conditions are extremely poor. The trees never reach a normal yield. Since all the plant foods have been exhausted in their available form, a complete fertiliser may be preferable to nitrogen alone. It may be remarked that when the bad conditions have gone on for a very long time, the prospects of producing remunerative results become very remote. In such cases, with the modern prospect of high-yielding budded rubber, it may often be better to consider replanting at once, rather than devote time and money to a treatment of uncertain promise. A replanting scheme may not be so very much more expensive, either of time or money, than manuring, to bring the area into normal bearing, since the essential feature in both cases is the growth of completely new tappable bark. At the conclusion, the replanting will provide a much higher *potential* (inherent) yield than the old planting ever had, and one result of this is that any future expenditure on manuring or other improvements is more feasible,

since the cost is still the same reckoned per acre of soil but less when reckoned per lb. of rubber produced.

The plantings which result from reclaimed 'lallang' grass land may be regarded as intermediate between the two cases considered above. Although the plant nutrients are usually exhausted by the previous crops, a certain recovery takes place during the years of abandonment. The rubber will require earlier manuring than in the case of virgin soil, but it makes sufficiently good growth to promise adequate response to such attention.

A second type of food deficiency which may be recognised by the appearance of the trees is that of potash. A large proportion of Malayan soils show a very small supply of potash. The type in which the deficiency is most marked is sandy, and is often rich and dark in appearance from the amount of humus which it contains. This is a very unusual feature for a sandy, well-aerated soil. It would seem in this case that the organisms responsible for the decomposition of the humus are themselves in a similar position to the trees and unable to find sufficient mineral food. The symptoms of potash starvation produced in the tree are stunted growth, and leaves which are crinkled and often unnaturally dark green in colour. These tend, however, to turn completely yellow quite prematurely, the discolouration beginning at the edges. The symptoms indicate that the ratio of nitrogen to potash is too high and the addition of sulphate of potash is sufficient to restore normal growth and healthy conditions. By stimulating bacterial activity it accelerates the setting free of the locked up nitrogen in the organic matter.

In regard to phosphate, Malayan soils usually contain good reserves, so that mature stands of rubber usually do not require this element. Indeed, some experiments using phosphate alone have had the effect of depressing latex yield and this has led to the recommendation that the use of phosphate on mature rubber should be approached with caution. On the other hand, the available phosphate appears to be badly exhausted by the crops which have preceded the rubber, for which reason phosphates often produce great stimulation of growth in young rubber which has been planted on such sites. There is also some reason to think that the young tree may have a greater need of phosphate than the mature tree. Reports from Sumatra indicate that good results have followed the use of phosphates even in old rubber and that basic slag and rock phosphates have proved more reliable than superphosphate.

On hilly situations the case sometimes arises that the soil, though containing an adequate proportion of plant foods, exists as such a thin layer over gravel or rock as to be insufficient to support normal growth. In such cases a complete fertiliser is the logical requirement.

## Immature Rubber.

In addition to the maintenance of yields, manuring may also be applied to produce earlier maturity of young rubber. It is well known that clean weeding, by stimulating humus decomposition, causes a more rapid growth in young

rubber than is observed when covers are allowed to grow. It may be suggested that in some cases this is an extravagant policy with bad after-effects, and it might be better to pursue the more economical policy of establishing a cover to reduce humus losses, while making up for the retardation in growth by the use of artificial fertilisers. One caution is necessary in manuring young rubber, namely, that if nitrogen is given in too heavy a dose the growth of the leaf canopy may outstrip the strength of the young stem and cause the trees to bend over and break. It may be said that on areas which have been reclaimed from swampy conditions nitrogen is not required, at least for many years. Sufficient stores are locked up in the accumulated vegetable debris and may be set free by the judicious use of mineral fertilisers such as kainit (a potash fertiliser) and basic slag (phosphate).

## Resume of Results to Date.

The best known and most convincing results from the manuring of rubber are those obtained by the Holland American Plantations in Sumatra. Details have been published by J. Grantham in "Archief voor de Rubbercultuur" (August 1924 and October 1927). The figures have since been repeatedly reproduced and it will here suffice to recall the main features. Rubber of about 8 years old growing on a white sandy-clay soil and suffering from die-back with symptoms of nitrogen starvation, was manured with nitrogen fertilisers. The yield in 1919 at the beginning of the test was rather under 300 lbs. per acre and has remained fluctuating round such figures on the control plots ever since. The manured plots began to improve at once and the yield on them has gone steadily forward during ten years or more and has now reached the normal value of good rubber round about 700 lbs. per acre. The benefit does not yet appear to have reached its maximum, according to latest reports. The greatest benefit was from nitrate of soda applied at the rate of 5 lbs. per tree every year, but the plots receiving an equivalent amount of ammonium sulphate in alternate years are not far behind. Such a return is in the highest degree economic, but it has only been found so far on the particular type of white soil. In other cases and with other soils results have usually not been so striking.

Schmöle reported results from a number of experiments in other parts of Sumatra ("Archief voor de Rubbercultuur," June 1926) which in the main did not give such conclusive results. It appeared that all tests on the typical white sandy-clay soil similar to that on which the H.A.P.M. had got such success showed a response to nitrogen. Other soils often showed a small response to nitrogen, but rather doubtful results with other constituents. The results from Java summarised by De Vries showed for the early years that only about one quarter of the experiments gave satisfactory increases, while the remaining three quarters were still dubious as to conclusions. Similarly in Malaya, results have been on the whole inconclusive during the 2 or 3 years that experiments have been running, but there have been enough positive results to indicate great possibilities. It remains to define clearly the conditions which decide success or failure. The general inference which it is possible to make at this stage is

that all cases of a quick economic return have been from rubber of a young age class (up to 12 years or so). All that can be said with regard to the majority of experiments on older rubber is that improvements in appearance can usually be effected quickly, but the response as regards yield is delayed beyond the 2 or 3 years of which we have so far any record.

## Conclusion.

From the foregoing remarks it will be clear that manuring of rubber must be regarded as still in the experimental stage. Estates should be encouraged to make the small expenditure necessary to provide for their own experiments. Such experiments, being conducted under their own local conditions, will give results that may safely be relied upon for guidance as to further expenditure. In regard to such experimentation they would do well to invite the help of their Research Institutes in laying down the plans, since the value of an experiment depends very much upon correct design at the start. The one fact that must not be lost sight of is that no inference as to the results can be exact unless control areas are left as a basis of comparison. It is also well to have expert advice as to the type of fertiliser most likely to give results under the special conditions. Although nitrogen is by far the most general need, there are cases where it would be waste of money to apply it alone. Peaty conditions usually maintain nitrogen reserves for very many years, while in other cases the addition of nitrogen can only be effective if balanced by other constituents. In passing, it might be pointed out that experiments which fail should be put on proper record as well as those which succeed. It is only in an economic sense that failure means rejection; in a scientific sense a failure may give new information as valuable as a success.

The future of manuring in rubber would seem to show good prospects. In a number of cases the results already show a good return, and it cannot be doubted that as the length of time and the number of experiments increase, a larger proportion of them will show good results. Another factor for the future which must be reckoned with is the very much higher production per acre which may be expected from buddings now being planted. In such a case, the cost of manuring per pound of rubber produced will be correspondingly reduced. A high yielding tree requires no more food for health than a poor yielder. Thus, areas which will later be coming into tapping may repay more handsomely the cost of using fertilisers to keep them up to their full yielding capacity. At the present time the most important point to be realised is, in the writer's opinion, that manuring of mature rubber should be begun in time. If deterioration sets in, and is allowed to run unchecked for a number of years, much time and money must be spent to make up for the leeway lost. The value of manuring must be considered not simply in terms of the increased yield from an area, but in terms which allow for the amount of deterioration which would have been inevitable without such treatment. The profit and loss account of such treatments must also be carried over a number of years for fair conclusions, since the processes are slow by which the trees appreciate or depreciate in their health and yielding-vigor.

# CULTIVATION OF PINEAPPLES.*

BY

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*Agricultural Economist.*

Hawaii and Malaya are the world's main centres for the production and canning of pineapples. The estimated area in bearing in Hawaii is 50,000 acres; while Malaya has a total of about 50,000 acres, 42,000 acres of which are situated in the State of Johore, and 8,000 acres on Singapore Island. Pineapple canning is also carried on to a lesser extent in South Africa (centred at Port Elizabeth), in Formosa and in parts of Australia.

The following account is a comparison of the systems of cultivation and the conditions obtaining in Malaya, Hawaii and South Africa.

## Climate.

The climatic conditions in these three countries of production vary considerably. The following table shows the average rainfall and temperature.

| Country. | Average Rainfall inches. | Average mean shade temperature. |
|---|---|---|
| Malaya (Johore) ... | 89.09 | 80.0 F. |
| Hawaii (Honolulu) ... | 31.60 | 74.6 |
| South Africa (Port Elizabeth) ... | 22.51 | 63.6 |

In Hawaii, the precipitation is heavier from November to March inclusive, but in South Africa the rainfall is fairly evenly distributed throughout the year. The rainfall in Johore is somewhat erratic; the rainy months are generally December to March, but there is usually an ample rainfall each month.

The above figures demonstrate that pineapples will flourish within wide ranges of climate in the tropics or sub-tropics, but the system of cultivation must vary between these countries to adapt the crop to local climatic conditions.

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* The following account is compiled from information obtained over a number of years by Officers of the Department of Agriculture S.S. & F.M.S, regarding Malayan Pineapple cultivation; "Notes on the Pineapple Industry in Hawaii" supplied to the Director of Agriculture from a private source; and "The Pineapple Industry in South Africa" from a report by Mr. C. A. O'Conner of the Mauritius Department of Agriculture. Reference has been made to "Notes in Pineapple Cultivation" appearing in "*The Tropical Agriculturist*" Vol. LXX, No. 1. January 1928, and to "Growing and Canning Pineapple in the Hawaiian Islands," in *Dun's International Review*, April 1928.

## Soils.

Pineapples will grow on a wide range of soils, but favour the heavier types of soil with good soil aeration and drainage. The soils of Hawaii are of volcanic origin and rich in mineral plant foods. In Malaya, the crop thrives best on the stiff clay types of soil. A rich soil is held to be unsuitable as it tends to develop the size of fruit at the expense of flavour. It is for this reason that the fruit produced on the poorest of the Singapore lands have the best flavour when canned. It is probable that with a rich soil, growth is more rapid in Malaya than in either Hawaii or South Africa with their lower rainfall and temperature.

## Varieties.

The two main varieties used in canning are the "Smooth Cayenne", a large pineapple with small "eyes", weighing about 5 to 6 lbs. and the "Queen" type, a smaller pineapple, with deeper and rather irregular eyes weighing about 3 to 5 lbs. Opinions differ regarding the relative merits of these two varieties for canning purposes. It is held in Hawaii and South Africa—which have adopted the "Smooth Cayenne"—that the flavour of that variety is superior to that of the "Queen" types. In Malaya, the latter variety is used exclusively for canning as it is held to have a better flavour and to be more suitable for canning. Here again, it is possible that climatic and soil condition may be responsible for these differences of opinion, which, of course, are based on the experiences of the canners. The "Queen" type has two advantages of some importance—it is hardier, and it produces a greater number of "suckers" than does the "Smooth Cayenne", a matter of some importance in replanting or extending areas under the crop.

## Preliminary Cultivation.

The fundamental differences in system of cultivation between these three countries is that whereas in Hawaii and South Africa, pineapples are treated as a sole crop, in Malaya they are almost invariably planted as a catch crop; generally in conjunction with Para rubber as the permanent crop.

In each case, it is realised that pineapples cannot be grown indefinitely on the same land: the land must either be rested after a number of years or it must be utilised for alternative crops after carrying pineapples for some years. The Hawaiian rich soils vary considerably; in some cases they produce fruit for three or four years, after which resting for one or more years is necessary; in other instances they are still bearing well after fifteen years. It is reported that many of the soils, however, are finished for pines after eight years. In Malaya, virgin soil is generally used for pineapple cultivation. The pineapples are planted directly the heavy jungle is felled, burnt and cleared. The plants commence to fruit in from 12 to 18 months, and will continue to fruit until the

fifth to sixth year, by which time the fruits produced are small. The rubber which forms the main crop has also become a tree of considerable size, so that further cultivation of pineapples is out of the question.

Much of the Hawaiian pineapple land was formerly pasture land, but newer areas, in many cases, had to be cleared of cactus and rocks. It was never jungle and the islands are not thickly wooded. Abandoned land reverts to pasturage.

The South Africa pineapple land has to be cleaned of bushes and grass.

Both in South Africa and Hawaii, the preliminary cleaning of the land is followed by a thorough cultivation of the soil. In the latter country, 95% of the land is cultivated with caterpiller tractors, steam ploughing equipment never being employed. As mentioned previously, in Malaya the land receives no cultivation before planting the pineapple plants.

## Planting.

Pineapple planting material is of four descriptions: viz., ratoons, which are formed from buds on the stem among the roots; "suckers", formed in the leaf axils; slips, formed from buds appearing immediately below the fruit; and crown slips and crowns, formed from buds beneath and around the crown of the fruit. Ratoons and suckers are the most suitable for planting purposes, as they produce fruit earlier than do the less strongly developed slips, which are very small and should first be planted in a nursery to develop a strong root system. The effect of planting material and climate may be seen from the following comparison of the length of time taken for the plants to reach the bearing stage.

| Country. | Crowns. | Suckers. |
|---|---|---|
| Malaya | 18 months | 12 months |
| Hawaii | 20 months | 14—16 months |
| South Africa | 2 to 2½ years. | |

Considerable variation exists with planting distances employed in different countries. The usual Malayan system is to space the plants 5′ x 2½′, with a six foot path at every 100 feet. This spacing gives from 3,000 to 3,400 plants per acre. In Hawaii, it is customary to plant very close, 9,000 to 12,000 plants per acre, with a tendency towards an even denser population of plants. Slips or suckers are usually planted in double rows, 12 to 18 inches between plants in the row, 16 to 24 inches between rows. The distance between the centre of this double row and the centre of the next double row is about 6½ feet.

The South African practice is to plant in double rows, the plants being two feet in the row and two feet apart between rows: a space of five feet is left between the double rows. In this system there result about 6,300 plants per acre.

Suckers and ratoons for planting are cut square at the base, the lower leaves removed and frequently dried in the sun for a while before being planted.

In some quarters it is held that there is no advantage in the preliminary drying, but it appears to be the usual practice both in Malaya and Hawaii.

The plants should be placed from three to four inches deep in the ground—the actual depth depending upon the size of the plant. Care must be taken that no soil or sand enters the bud as it will kill the plant, or at least retard its development.

## Cultivation.

After planting, the fields require weeding, but apart from such attention no further cultivation is given in Malaya. In the other countries of production, however, the low rainfall renders it necessary to do everything possible to conserve the moisture in the soil. The usual method of frequent surface cultivation achieves this object, but in Hawaii, exceptional measures are taken, partly at least towards this end. The fields are mulched, with an asphalt-treated paper so spread as to provide spaces necessary for cultivation and harvesting. It is claimed that this mulch (under the commercial name of "Pabco") reduces weeding costs, conserves heat and moisture; and so increases yields as to render it a financial success. The "Pabco" is first spread—sometimes by a machine which lays it flat, turns down the edges and kicks up earth to keep it down— and the plants placed in holes made in it with a trowel. The disadvantage mentioned against the "Pabco" mulch is that it forms a breeding ground for pests. This mulch is widely used in Hawaii. Owing to the heavy rainfall, it would not have the same advantages in Malaya. Pineapple land is ploughed four or five times a year on African plantations, the ploughing being done with oxen.

Mention must here be made of a peculiar feature in pineapple planting in Malaya. The great majority of the areas under this crop are owned by Chinese, who, in many cases, are the owners of the factories. The Chinese owner of land which he wishes developed with pineapples and rubber makes an arrangement with a number of Chinese squatters to plant up his land with pineapples and to keep it clean for an agreed charge per month per acre. Each squatter is thus definitely and absolutely responsible for a portion of the estate, and generally erects his own temporary abode thereon. The agreement provides that a squatter shall get 50% of the value of the pineapples as a bonus, after cartage costs have been deducted and the agreement usually contains a clause which provides for the payment to the squatter of a certain sum per acre for cleaning the pines off the land after five years. In one typical instance, the agreement provided for the payment to the squatter of \$1/- an acre a month to cover the full cost of planting and weeding, a bonus of 50% of the value of pineapples after deduction of cartage costs, and the payment by the owner of \$8/- per acre for cleaning off land and burning the pineapple plants at the completion of the agreement.

Such complicated methods of management are possible between Chinese and Chinese, but are impossible between European and Chinese.

The usual Malayan contract rates are around \$7/- per acre for planting; and for weeding and earthing up plants, \$2.50 per acre per mensem.

In Hawaii, the land is manured just before planting, and a further application is sometimes given before the plants commence to bear fruit.

It is difficult to obtain data of the labour requirements for cultivation, but some idea of the probable cost can be obtained from the requirements of an Hawaiian plantation. An estate of three or four thousand acres is run by one man. Under him are Japanese conductors, one for every 1,000 acres. They will have under them ten heads of coolie gangs, each of which would be in charge of about ten coolies at the height of the season. Salaries: Manager about $1,000 per month; Divisional Manager $550; Conductor $90, all sharing in profits.

The permanent labour force is about 60 men per 1,000 acres, a number which is in excess of requirements in the slack season. This number may be increased to over 100 men per 1,000 acres during the busy season. Formerly, the labour force was mainly Japanese, but owing to restriction on Japanese immigration, they have now been largely replaced by Philippinos.

**Yields.**

In Malaya, there are two main crops per annum, the first in May and June and the second in November and December, but the plantations are producing fruit throughout the year. During the first year of fruiting the plant will produce one fruit, but in subsequent years, two fruits per plant are usually obtained. The average annual yield is between 4,000 and 5,000 fruits per acre per annum.

Although there is fruit being obtained throughout the year, the main Hawaiian harvest, June to August produces the heaviest crops, with a second crop in December to February. When the first crop is obtained—one fruit per plant—all suckers, with the exception of two, are removed; as a rule, no further removal of ratoon are made unless they are required for planting purposes. The Hawaiian plantations, by reason of close planting, the application of manures and cultivation, produce heavier crops than are obtained in Malaya. In South Africa, the annual crop is estimated at between 6,000 and 10,000 fruits. Although the yields of pineapples from Malaya are small, it must be remembered that the capital invested is also smaller than with other countries, and that the land is planted with a second crop—rubber.

An estimate of the cost of bringing an acre of pineapples into bearing in Hawaii has been stated as follows (Currency, dollars gold).

Clearing $40; Ploughing $25; Plants $56; Planting $10; Weeding and ploughing $27; Fertilising $35; Harvesting $13.50; Collecting $36.—Total $242.50.

It must be understood that subsequent crops will cost very much less; the only fair way of arriving at cost being to average it over a period of not less than four years.

In a subsequent number of *The Malayan Agricultural Journal*, it is proposed to conclude this series of articles on pineapples by a consideration of the subject of Pineapple Canning.

# SELECTED ARTICLE.

## THE PREPARATION AND WORK OF RURAL SCHOOL TEACHERS IN MALAYA.*

BY

O. T. DUSSEK,

*Principal Sultan Idris Training College for Malay Teachers, Tanjong Malim, Perak.*

The Sultan Idris Training College, a large residential College founded and controlled by Government and modelled on the lines of an English public school, trains Malay pupil teachers for service as schoolmasters in the Malay vernacular schools, and forms Malaya's sole source of supply in this respect. The college course is of three years' duration; there are 375 students, 125 to each year, divided into fifteen classes each of twenty-five. The medium of instruction is Malay. The College aims at establishing its own 1st class certificate as a standard equivalent in the vernacular to the Cambridge school certificate in English, and its own 2nd and 3rd class certificates as equivalent to the Cambridge junior local certificate.

The aim of the Malay vernacular schools as defined by the Government in 1920 'is not to turn out a few well-educated youths nor yet numbers of less well-educated boys; rather it is to improve the bulk of the people and to make the son of the fisherman or peasant a more intelligent fisherman or peasant than his father had been, and a man whose education will enable him to understand how his own lot in life fits in with the scheme of life around him'. The great majority of the indigenous population of Malaya is engaged in agriculture, so that it has long been considered necessary for Malayan vernacular education to have an 'agricultural bias'. In the vernacular schools horticulture and at least one other industry are taught, and a pass in one industrial subject required for the certificate that marks the completion of the course. A system of school and home gardens has been adopted, and a scheme approved for European inspectors of agriculture attached to the training colleges as teachers to supervise agriculture. The curriculum of the Sultan Idris Training College for Malay school teachers is designed to carry out this policy.

The College is situated in a rural area, and not near a large town. This is considered important as affecting the mental outlook of the students. We do not desire to do anything to increase the lure which the towns undoubtedly exercise on the youth of all countries and races. The choice of a rural site had

* Reprinted from 'Oversea Education' Vol. I, No. 2. January, 1930.

the additional advantage of enabling Government to acquire a sufficient area of land at a moderate price. The College grounds cover an area of seventy acres of flat land.

School gardening with rural husbandry plays a large part in the curriculum, both theoretical and practical. The method of instruction is that from which the student will derive most benefit and advantage, when he either takes up his post as a schoolmaster, or returns to his own village. In this training, which is extended over the three years of the college course, every effort is made to present the subject to the boys in an attractive and palatable manner. Secondly, it is essential that the practical advantages of work on the soil shall be proved beyond all shadow of doubt—this being the surest road to success. The first year introduces the students to soils in all their complexities and activities. The various methods of soil improvement are fully discussed and practical examples given in the outdoor work. At the same time, the relation of plants to the soil, their elementary structure, their food materials and their means of absorbing such materials are explained as simply as possible. Apart from explaining the cellular construction of plants and discussing their outward form, it has been found better to leave the study of the real botany of the plant until the second year, when the student's mind has to some extent at least been trained to think on scientific lines. Diagrammatic work on the blackboard is largely practised by every student; there is no better way of preparing the student for his future work, and of informing the teacher how much of the lesson has been grasped. A written test of the work done is held every two months.

On the practical side, in the first and second years, each student has an individual plot, divided into three ridges, and for this, subject to the advice and supervision of the staff, he is held entirely responsible. Four mornings per week from 6.30 to 7.30 a.m. and one afternoon from 4.45 to 6 p.m. are devoted to this outdoor work. On each of his three ridges he plants a different crop and as he has at least two crop changes per year, he acquires a general knowledge about the growth and habits of at least six different crops. Each boy has a note-book into which he enters day by day the precice nature of the work done in his plot. At the same time he has a card-index which he fills up from time to time, and so gains some experience in recording work. Plots are inspected monthly, and marks awarded for the condition of the crops grown, tidiness, amount of care expended, etc.

In the second year the individual plot system of outdoor work is continued, but as far as possible a different series of crop is grown. At the same time each student is given one large tree to be under his special care. This may be either a fruit tree or an ornamental tree in the college grounds. He is responsible for keeping that tree in the healthiest possible state, and if he discovers it is diseased he immediately reports the matter to a master or one of the third-year students, who instructs him how best to combat the disease. In the case of a disease so far not described to the students, the whole class is gathered round the diseased tree and a short lecture given. It is found that in

this way the boys gain a fair knowledge of the common trees of their native land, the disease to which they are subject, and the best means of disease prevention and control. At the same time they acquire a keen interest in the upkeep of the college grounds, and unconsciously prepare themselves for further work on these lines during their third year.

On the theoretical side, the term commences with a thorough study of plant physiology and anatomy. Though no laboratory work is possible, each student is supplied with a specimen of the plant or part of the plant about which the lesson is being given. Whenever possible, sections are cut and demonstrated under the microscope to each student in every class. In time it is hoped that the students will be able to undertake a little microscopic work on their own. Later in the term the various methods of plant propagation are studied, and here again practical work plays an important part. The College has its own nurseries for which under European supervision the boys are responsible. Demonstration and actual practice are given in reproduction by layering, suckers, grafting, budding, and cuttings. A study of the best and most up-to-date planting methods for garden crops is made and in turn carried out by the boys in their individual plots. This method of teaching has proved very successful in the College, the crops now under cultivation being of a very high standard indeed. Its introduction into the villages through the medium of the College students who become vernacular school teachers will do much to promote native happiness and prosperity. The term is brought to a close by a study of animals and their relation to plants. The importation of stock, and the inter-breeding of imported with indigenous stock, open up vast and difficult problems best left to Government specialists. This subject is but lightly touched upon in the curriculum. But the problem of animal nutrition, of vital importance in the tropics, receives as much attention as conditions will allow; it is hoped in the near future to demonstrate actual feeding experiments at the College itself.

The third year is essentially a year of application. The students are given actual practice in teaching in the vernacular school which is attached to the College. Then in their outdoor work the individual plot system is dispensed with and various other outdoor activities undertaken. In each year there are five classes, A, B, C, D and E; so five different types of work are allotted and each class undertakes one; every three weeks a change-over is made until finally every third-year student has experience of each type. About one term is necessary to complete the rotation of these duties, and in the second term it is hoped to allot five other schemes of work, so that at the end of the year the students will have had experience of ten different types of work. The scheme at present in use is as follows:

A. Care of orchard, planting of new fruit trees, pruning and manuring where necessary.

B. Care of nurseries and large communal plots. This includes sowing of seed, care of seedlings, transplanting, thinning out, &c. Also practice in care and harvesting of a fairly large variety of crops.

The communal plots include maize, sweet potato, ground-nut, tomato, lettuce, Lima bean, long bean, French bean, &c.

C. Care of the grounds under economic crops. At present this only includes pineapples, tea, bemban, mengkuang, and coffee, but it is hoped to extend the scope in future. This gives considerable practice in disease control and cultivation methods.

D. Supervision of the plots of first and second year students, with advice and help to them where necessary.

E. Ornamental work and care of flowers in college grounds. This includes experience in the laying-out of flower-beds and in the general decoration and improvement of gardens.

We propose to choose next year a few students who exhibit any particular aptitude for gardening work and give them a few simple agricultural experiments to carry out, e.g. spacing experiments, variety yields, &c.

The theory work in class includes a general study of plant and animal pests. At the beginning of the term a thorough study is made as to what is meant by 'disease,' followed by a study of the common practicable methods of disease control and application of these methods to their work in the gardens. Later in the term the major economic crops of Malaya—rubber, coconuts, rice, &c., come under review; here again simple and practical measures alone are adopted and emphasized. Short talks dealing with the economic aspects of agriculture, e.g. marketing, co-operation, and costs of production, are included in the course of study. Finally as the students are being trained for appointment as teachers in vernacular schools, instruction in the special details relating to organization and development of school gardens is given.

When one considers the wonderful improvement in the grounds of the College during the last five years and realizes that it has mainly been brought about by the students themselves it becomes abundantly evident that much can be accomplished where there is discipline and the will to work. The idea is, at present, to try and get each year of students to leave some definite result of their handiwork in the grounds. In the matter of crops grown the high standard attained by the students is demonstrated by the large number of prizes of all classes gained by them at the various agricultural shows throughout the country. When the ex-student has become a teacher in some village school, the practical side of his training at the College serves him in good stead. Often he has a piece of barren ground to plan out and develop into vegetable, fruit and flower gardens. In no case will he ever inherit a piece of ground which is not capable of improvement and development. The good garden work which is being done in schools is evident both in the large number of exhibits and the large number of prizes which these exhibits obtain at shows. This procedure should be encouraged to the fullest extent, as competition always creates healthy activity.

From the comprehensive and practical instructions on the teaching of rural

science issued by the Education Department to all teachers, the following notes are taken:

> Every teacher should make a plan of the school gardens, showing improvements and forms of cultivation, e.g. vegetables, fruits, flowers, &c., together with plots of the individual pupils.
>
> In order to facilitate planting and cleaning, vegetable plots should be not more than four feet wide. Each should be numbered and should bear the pupil's name.
>
> Each of the higher forms should have a communal plot to teach the value of co-operative labour.
>
> Every pupil should keep a note-book recording instructions given in gardening, together with the day when the seed was planted, when it sprouted, when it flowered, &c., weight of crops, pests encountered, &c.
>
> One of the elder pupils should be in charge of school gardens under a teacher, and one pupil should be in charge of the work of each standard, another of seeds, another of crops.
>
> The teacher should award marks twice a term both for individual and for communal plots.
>
> Produce of the school crops may be divided among the students responsible and taken to their homes, or they may be sold and the proceeds used for school purchases, e.g. on prizes for gardening or school sports. Careful accounts of expenditure and receipts should be kept.
>
> All teachers must remember that they are expected themselves to work in the gardens, and that class work is only a preparation for gardening work.

The visiting officials of the Education Department regularly inspect the entire work of the school including the practical work in rural husbandry, and marks are allotted for cleanliness and condition of school gardens for which full credit is given in the annual grading scheme.

The co-operation of agricultural officers, as it becomes available, will greatly improve this garden work. Careful regulations, which define the relations between the Agricultural and Education Departments, provide among other things for the scrutiny of all arrangements for the establishment and equipment of school gardens and for their periodic inspection by agricultural field officers, on whom also inspectors of schools rely for the supply of such planting material and seeds to schools in their areas as masters cannot by their own efforts secure. Another subject that is engaging the attention of both Departments is that of encouraging pupils to apply to their home gardens the methods learned at school, and to bring their home difficulties to school for discussion.

I can say with confidence that the introduction of manual training, and particularly of school gardening, has had a profound effect on the attitude of the Malay schoolboy towards manual work of all kinds. I cannot improve on the language used in this connection by the Director of Education: "The old-

fashioned Malay teacher, puffed up with a little learning and full of the old oriental scholar's prejudice against manual labour, was ashamed to dig; he now delights in handicrafts and in practical acquaintance with the rotation of crops, the selection of seeds and the study of pests." The attitude of the new teacher is reflected in the new pupil. The new pupil has begun to realise that his education in the school is a real preparation for life. There can be no doubt of the success of school gardening in the Malay vernacular schools, and in my opinion the two essential factors in that success have been—

(1) the provision of adequate skilled instruction in the Teachers' Training College;

(2) the supervision of the village school gardens provided by the staff of the Agricultural Department. That supervision the newly appointed Director of Agriculture is anxious to extend. Both the Education and the Agricultural Departments realise that co-operation must be real to be effective.

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## AGRICULTURAL SHOWS, 1930.

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Seventh Malayan Exhibition, Kuala Lumpur, April 19th—21st.

Negri Sembilan Agricultural Show, Seremban, July 25th and 26th.

Malacca Agricultural Show, Malacca, July 26th.

Pahang East Agricultural Show, Kuantan, First week in September. Date not yet fixed.

Pahang West Agricultural Show, Temerloh, August or September. Date not yet fixed.

Perak North Agricultural Show, Taiping or Kuala Kangsar, August. Date not yet fixed.

Perak South Agricultural Show, Tanjong Malim, August. Uncertain.

## REVIEWS.

### The Report of the Agricultural Commission in the Colony and Protectorate of Kenya.

A copy has recently come to hand of the report of the Agricultural Commission of the Colony and Protectorate of Kenya and is a document of considerable interest. The Commission was appointed in September, 1929, the terms of reference being—

1. To consider and make recommendations with regard to the progress of the main branches of the agricultural industry (including native agriculture and stock) since 1920.
2. Factors which tend to retard progress if any and the means whereby production may be increased and accelerated.
3. The provision which should be made for augmenting departmental or other services calculated to advance this industry and the share if any which should be borne by organisations or undertakings representing or concerned with agricultural interests and productions.
4. The formation and functions of advisory, consultative or other bodies in connection with the agricultural industry.

The Chairman of the Commissioners was Sir Daniel Hall; the Report which consists of a document of some 54 pages together with appendices covers a period of work dating from the 12th of September, 1929, to the 29th of October, 1929. The Report itself is dated October 23rd, 1929. It will thus be seen that a remarkable amount of work has been carried out during a comparatively short period. The principal findings of the Commission are contained in a summary of recommendations which is prefixed to the main body of the Report.

The first subject dealt with is the question of the appointment of a Minister of Agriculture, which the unofficial members of the Commission recommended subject to constitutional difficulties being overcome; alternatively, if this recommendation was not found possible, they recommended the establishment of an agricultural board, which latter suggestion was subsequently unanimously endorsed by all members of the Commission. The title of the proposed Board is that of Board of Agriculture and Development. It is proposed that this should be purely an advisory body and that it should deal with all questions connected with agriculture including animal husbandry, veterinary services and veterinary research. It is further recommended that the Conservator of Forests and the Game Warden should attend meetings of the Board from time to time in order to ensure due consideration of the requirements of agriculture in the policy of their respective departments.

In relation to organisation of the Department of Agriculture, the Commission unanimously rejected the proposal for separating the agricultural and

veterinary services and considered that these should continue to form an integral part of the Agricultural Department. They further recommended that a quarterly conference should be held between the various branches of the services which the Governor should initiate and over which he should from time to time preside; on the crop husbandry side the Commission advocated a formal conference once a year between the Agricultural Officers and the members of the Research Services.

The Commission put forward various suggestions for the extension of agricultural services including institution of a plant breeding section of the Department, appointment of Agricultural Economists, the institution of an Engineering Branch of the Department pertaining to machinery, and the improvement and extension of methods of disseminating information. It also discussed the question of the appointment of agricultural officers specialising in education, but did not consider that the Agricultural Department should set up a branch for advising on land or for surveying and reporting on land.

In relation to agricultural problems generally, the Commission considered that there is a pressing need for further credit facilities in the Colony and recommended the Government to institute special inquiry into this question.

In relation to the livestock industry, the Commission considered that while the necessity existed for building up a scheme of mixed farming, the realisation of this project could only proceed slowly on account of the problem of disease among livestock. It expressed doubt whether existing quarantine regulations can be successfully enforced and recommended that new regulations should receive consideration. It also considered the question of an Experimental Stock Farm and if such a project is approved, indicated that the scheme has three objects:

1. The building up of an improved native herd by selection within the local breeds of cattle, coupled with experiments on grading up by the use of Indian and Africander sires.
2. The maintenance of a dairy herd kept entirely indoor on the soiling system.
3. The creation of paddocks of improved grasses.

The Commission recommended the institution of certain experimental farms, particularly one in the coastal area, with the object of encouraging development. It also dealt with the need for some educational assistance to the Indian cultivators in the Nyanza Province, and discussed questions of closer settlement of land, the possibility of introduction of British agricultural skilled labour and stressed the necessity for maintaining an agricultural atmosphere in the native schools so as to avoid the tendency to turn out clerks or odd-job men instead of artisans and agriculturists. It further considered that the fisheries should come within the control of the Department of Agriculture.

The question of the formation of special research stations in relation to particular industries was also considered and the opinion expressed that such research organisations are indicated in the case of the coffee and the sisal in-

dustries. The principle of the schemes put forward by the Coffee Planters' Union and the Sisal Growers' Association was generally approved.

A considerable section of the report is devoted to discussion of native agriculture with special reference to the characteristics and customs of the different native tribes which inhabit various parts of the Colony. Each of these tribes has its own particular set of conditions and requires to receive different treatment in relation to agricultural policy.

In general, the point is stressed that improvement of native agriculture is closely bound up with the general problem of raising the physical health and the education of the natives and that it follows therefore that an advance in native agriculture as in other respects is but a part of the work of administrative officers. The Report stresses the need for the unification of services to the extent that agricultural officers should be seconded for service in native reserves and attached as advisers to Provincial Commissioners, advising District Officers in regard to agriculture and leaving the execution to them.

The question of the improvement of agricultural conditions throughout the British tropics is one of high importance; in all tropical regions increasing attention is being devoted to such questions by the official and unofficial representatives of the communities; as a comprehensive idea of the conditions and requirements in the various tropical regions as a whole can undoubtedly prove of great assistance in solving difficulties and establishing a policy in any particular region, the report may be commended to the careful study of all those who have to deal with questions of this description in Malaya.

H. A. T.

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## Seedling Fruit Stocks.

BY

*H. B. Tukey. Bulletin No. 569 April, 1929, New York State Agricultural Experimental Station, Geneva, N. Y. Published by the Station Under Authority of Cornell University.*

In this bulletin, a very lucid account is given of the methods employed by American nurserymen in raising fruit seedlings as stocks for budding and grafting. In the past, the supply of root stocks has been largely met by importation from Europe, but owing to the embargo on imported stocks which comes into force on June 30, 1930, American growers are now giving the matter considerable attention.

The majority of fruit tree stocks employed in America at the present time are seedling stocks. Investigations are centered upon the production of stocks from superior clones with the object of obtaining greater uniformity in orchards. When stocks are propagated vegetatively, uniformity of type is readily secured, but in the case of seedlings, which the nursery trade is dependent upon, considerable difficulties are encountered.

It is not necessary here to recapitulate the information advanced regarding the various stocks recommended for the temperate fruits under consideration, namely, apple, pear, plum, cherry and peach, as such information has no local

interest. In the tropics, where climatic conditions are almost constant, such matters as time of planting, period of after-ripening i.e., the period between removal of the seed from the fruit to sowing, do not arise. On the other hand, the principal of growing desirable forms of fruits on robust stocks, as practised in temperate countries, is considered to be a necessary concomitant to the improvement and culture of Malayan fruits.

In New York State, two types of seedling trees are grown, those with straight roots for grafting and others with branch roots for budding. The seeds are usually sown in drills 36 inches apart so as to allow surface cultivation with horse labour. Such cultivation is undertaken with the object of preventing the formation of a crust on the soil.

Transplanting may take place after the first or second years growth according to circumstances. Three methods are used in this operation, namely, dibbling the seedlings into the soil by hand, the use of transplanting boards, and automatic transplanting machines. The first method is satisfactory when care is taken in planting, but American labour objects to the drudgery entailed by such work. The best results are obtained by the use of the planting board. Several types of planting boards are used; that commonly employed being 3 feet long with notches ¼ inch deep and 3/16 in. wide, the notches being 1½ inches apart. The seedlings are kept in place by an elastic band drawn across the front of the board. Three such boards capable of holding a total of 75 seedlings are held together in a frame. The seedlings are placed straight against the sides of the trench and the soil pressed firmly round their roots. The board is then removed, leaving the young plants properly spaced and with their roots in a vertical position. Transplanting machines are in use, but are not considered sufficiently advanced as yet to be practical. One type of machine, however, fitted with a special feeding attachment, and capable of being drawn by a tractor, has been used successfully. This machine, worked by two men, is able to plant 30,000 seedlings in a day.

It will be seen that the raising of seedling fruit stocks is an important undertaking in America. The question may well be asked; can such methods be employed profitably with tropical fruits in Malaya? In the opinion of the reviewer of the bulletin under consideration, the answer is a decided, yes. Taking four fruits commonly grown in the Malay Peninsula, namely, mangosteen (*Garcinia Mongostana*), duku (*Lansium domesticum* var. duku), rambutan (*Nephelium lappaceum*), and pulasan (*Nephelium mutabile*); all these fruits are readily propagated by budding on to seedling stocks. Whether these fruits are capable of being budded into seedlings of allied species is unproved but not improbable. Ridley (*Flora Mal. Pen.* 1922) records some three dozen *Garcinia* spp. as being indigenous to Malaya. Likewise *Lansium*, two species; and *Nephelium*, thirteen species. An investigation into the possibilities of these and other wild trees as stocks for the cultivated forms might provide useful results. The subject, however, is a large one requiring much time and work before practical results may be forthcoming.

J. N. M.

# FROM THE DISTRICTS.

## The Weather.

Throughout April the weather generally continued hot and rather dry though there were thunderstorms and heavy showers of rain which were somewhat local and varied considerably in number in different districts. Thus, while Singapore, Malacca, Selangor, the country along the main range generally and Western Pahang received an adequate rainfall, the prevailing drought was only partly modified by showers in Penang and Province Wellesley, parts of Perak and of Negri Sembilan and on the east coast of Pahang.

## Remarks on Crops.

*Rubber.*—In Penang and Province Wellesley, many small holders have stopped tapping on account of the low price of rubber, being unable to pay tappers' wages. In the majority of cases tappers' wages have had to be reduced.

The only disease calling for comment is secondary leaf fall caused by the fungus *Oidium Heveae*. This was found to be fairly generally prevalent in Selangor, Negri Sembilan and Malacca on flowers and young foliage developing after wintering. The actual damage done to the trees was, however, not very serious.

*Padi.*—Padi harvest had been completed very nearly everywhere by the end of the month. The yields in Kedah and in Province Wellesley were poor as had been anticipated, while the padi planted in the mukims of Semanggol and Selensing in Krian and in certain parts of Larut District produced practically no crop.

Nurseries were being planted in Pahang. In Pekan District, the nurseries suffered badly from drought and had to be re-sown. In parts of Negri Sembilan and Malacca, water ways were being cleaned and repaired and the land cultivated for the coming season's crop.

*Coconuts.*—The exports of copra from Johore for the first quarter of 1930 amounted to 116,177 pikuls being an increase of 12,000 pikuls on the figures for the first quarter of 1929.

In Singapore Island, the caterpiller pest *Artona catoxantha* disappeared from palms in the three infected localities after the advent of heavy rains. In the South Eastern District of the Island, beetles are doing considerable damage and general conditions of sanitation and cultivation call for special attention. The nettle caterpillar *Setoria nitens* has for the time being ceased to be in evidence in Lower Perak District. A number of trees in Province Wellesley were struck by lightning.

The picking of unripe nuts for copra production is a noticeable fault in most coconut areas in Johore. This matter is being given attention. An abnormal

increase in the number of nuts required to make a pikul of copra has been experienced on estates in Bagan Datoh District and is attributed to the severe drought in 1929.

*Tapioca.*—Production of tapioca has been well maintained in Johore, exports for the first quarter of 1930 showing an increase of about 10,000 pikuls as compared with those for the corresponding quarter of 1929. A few factories in the north of the State were unable to operate in the first half of the month owing to shortage of water.

*Areca Nuts.*—Exports from Johore for the first quarter of 1930 amounted to 75,839 pikuls, a decrease of about 5,000 pikuls on the exports for the corresponding quarter of 1929.

*Pineapples.*—Factories in Singapore continued working during the month although the main crop is not expected to come in until the middle or end of May. Prices paid for fruit ranged from $1.30 to $2.80 per hundred. The prices received for canned pineapples varied from $3.45 to $3.80 per case of 48 tins according to type and grade of produce.

Exports of preserved pineapples from Johore continued to increase although prices were very low. During the first quarter about 5,370,000 fruits and 351,842 cases of preserved pineapples were exported, this represents an increase of 70,000 cases over the exports for the first quarter of 1929.

A new factory at Sungei Choh is now operating in Johore. A further area of about 3,000 acres of land has been alienated for the exclusive cultivation of pineapples and fruit trees.

*Fruit.*—A moderate crop of perennial fruits was observed on the east coast of Pahang.

*Food Crops.*—In Kedah, land has been cleared and planted with maize to supplement the food supply in certain districts. Dry padi will also be planted when the weather permits.

In western Pahang, further areas of maize and tapioca were planted during the month in the areas near the river, with the result that the actual area of food-stuffs appears to be considerably greater this year than in the past few years. Crops of maize are doing well in the bed of the Pahang river in the east of the State, but drought has affected the growth of vegetables.

## Notes on Demonstration Stations and Padi Test Plots.

*Kuala Kangsar Demonstration Station.*—Sales of produce from this station included 18,000 oranges at $1.50 per hundred, 50 coconuts at $3 per hundred and 148 ducks eggs at $3 per hundred.

Further incubation trials clearly indicate that very fresh eggs are necessary for successful hatching and past failures are undoubtedly due to the use of the stale eggs for incubation.

*Seremban Demonstration Plot.*—Seedlings of clove, nutmeg and rambutan, pepper cuttings, budded citrus plants, soya bean No. 13 and lesser yam No. 288 have been among the plants distributed from this station. The wet weather

following the drought has caused many of the orange fruits to split. Paper covers have proved an efficient protection to oranges against the attacks of fruit flys.

*Kuala Lipis Demonstration Station.*—The tapioca varieties recently planted have made very uneven growth, probably owing to the dry weather after planting. Two varieties of maize and one of groundnut together with red gourd were planted during the month. Considerable amounts of banana suckers of several varieties will soon be available for distribution.

*Pekan Demonstration Station.*—Plants distributed during the month included tomatoes, yams, maize seed, chili seed and seeds of various vegetables. A cicadid pest caused considerable damage to a number of plants. Control measures undertaken after reference to the Government Entomologist have proved fairly successful.

*Kuang Padi Test Plot.*—At this plot in Selangor the following yields were obtained.

| | | | |
|---|---|---|---|
| Seraup Besar | No. 48 | ... | 480 gantangs per acre. |
| Radin | No. 2 | ... | 440 ,, ,, |
| Local Padi Suta | | ... | 400 ,, ,, |

*Dong and Temerloh Padi Test Plots.*—On both these plots nurseries were sown during the month.

## School Gardens.

During the month, progress has been made with the preparation of the beds for replanting after the long holidays. Planting materials have been distributed and the requirements for new tools and for manures have been ascertained. Demonstrations of good methods of cultivation have also been given.

## Lecture at Tapah.

Early in the month, a lecture on plant propagation was prepared by the Agricultural Field Officer, Perak South and delivered by the Senior Agricultural Assistant, Batang Padang, at the mosque at Tapah after Friday prayers. This was followed by a demonstration by the Agricultural Field Officer of budding, grafting, layering, marcotting and cutting. About 80 Malays attended and appeared to be highly interested.

## Rats.

In Province Wellesley, 116,522 rats were accounted for during the month and 11,851 poison balls were distributed. In Krian, 48,944 rats were destroyed.

In Malacca, Tamil coolies have accounted for a large number of rats by opening up holes in the bunds. Particular attention is being paid to the clearing up of bush and other growth which provides cover for rats.

A number of rat traps have been distributed in parts of Pahang.

# DEPARTMENTAL NOTES.

## The Seventh Malayan Exhibition, 1930.

In order to convey information to the planting community concerning some of the important lines of work which were being carried on by the Department in connection with local crops, soils, pests and diseases, a comprehensive series of exhibits was staged at the Exhibition held in Kuala Lumpur on April 19th to 21st last.

The building used by the Department was 60 feet long and 36 feet wide, with a large central raised platform. Two small booths occupied one end of the room, whilst the other three sides were flanked with suitable benches. The whole was tastefully decorated and adequately lighted. On the central platform oil-palm and oil-palm products were staged. The two small booths were devoted to padi and coconut insects and publications, respectively. The benches were filled and arranged with exhibits of soils, padi and rice, tea, sisal, tuba, yams, coconuts and copra, rats, diseases of coconuts and oil-palms.

*Oil-Palm.*—The Agricultural Division's large exnibit illustrated oil-palm culture in its different stages. It comprised seedlings in sand-beds, seedlings ready for planting out in the field, male and female flowers, ripe fruit on bunches, loose fruit, seed, kernels, etc. The Chemical Division co-operated in staging this exhibit and showed the relative proportions of oil, kernels, shell and pericarp residue in oil-palm bunches; sections of fruit showing the sources of pericarp and kernel oils, pericarp oil in various natural colours; an illuminated 'waterfall' of palm-kernel oil, semi-bleached (butter-coloured) and fully bleached palm-oil. Demonstrations were given daily of the use of the bleached natural palm-oil for frying purposes, and the method of determining the percentage of free fatty acid in palm-oil in factories.

*Miscellaneous Crops.*—Besides the oil-palm exhibit, the Agricultural Division staged an instructive collection of useful crops from the Government Experimental Plantation, Serdang; these included tea, sugar palm, sisal, tuba and yams.

*Padi and Rice.*—This section was arranged by the Botanical Division and demonstrated more particularly how large increases in yield of grain are obtained by growing selected high-yielding strains of local padi. A collection of the best varieties of padi so far isolated and multiplied was staged in ear-form and as padi and rice. Leaflets describing the advantages to be derived by growing the pedigree seed were distributed. Numerous photographs of the rice selection work carried on in the Titi Serong Experiment Station were shown, together with large graphs illustrating the annual ratios of production to consumption and imports in Malaya. It was pointed out that only 25% of the rice

requirements of the population was now produced locally and that one of the means by which production could be increased considerably was by planting selected seed.

*Coconuts and Copra.*—In this section, which was arranged by the Assistant Chemist for Copra Research, a special feature was made of exhibits of copra illustrating certain common defects in the local product, the means by which these faults are brought about and how they can be avoided. Deterioration in quality and oil content, as well as of yield, were shown to be due—among other things—to picking under-ripe nuts, using those over-ripe, storage under wet conditions, insect attack, and burning during artificial drying.

Numerous analyses of the samples were given which indicated the extent of the depreciation in the quality of the copra. Exhibits of first class copra, together with their analyses, were displayed in order that they might be compared with the inferior ones. A large collection of coconut products, photographs of the coconut industry and diagram illustrating the variation in yield of individual tall palms on local plantations were also staged.

*Soil Exhibit.*—This was staged by the Soils Division to demonstrate the different types of soil which occur in Malaya.

Eight commonly occurring soils were shown, namely, quartzite valley, granite, Raub high-level, Raub low-level, dolerite, peat and coastal alluvium, as they occur in the field.

By means of a chart, the significance of differing mechanical compositions was indicated, together with the nomenclature of the different sized particles of which a soil may be composed.

The mechanical composition of the soils exhibited (at the surface and at a depth of 30 inches) was shown by means of a series of tubes, which actually contained the particles of which the soils were composed, sorted out into their different sizes; the numerical percentage of clay, silt, etc. being shown on cards placed beside the tubes.

The general properties of the different soils were defined by a series of small descriptive cards.

The different specimens were linked to a geological map by means of streamers thus showing where in Malaya these various soils are to be expected.

*Insect Pests of Padi and Coconuts.*—The Entomological Division concentrated its attention on the insects of coconuts and padi.

The insects of coconuts were mostly alive and specimens of the rhinoceros and red-stripe beetles with their grubs together with the nettle caterpillars (*Setora nitens* and *Parasa lepida*) were displayed. An unique exhibit was that depicting the insects which are found on the inflorescences of coconuts—the chief being the greater coconut spike moth (*Tirathaba tufivena*). Examples of spikes showing the damage to the male and female flowers by the caterpillars of this moth were shown and descriptive labels stated that by the removal of the sheath the damage done to female flowers by this moth was practically negligible. It was not claimed, however, that if the enveloping sheath were removed just

before the spike would burst naturally, all female flowers would eventually reach maturity.

Most of the principal pests of padi were shown. Of special interest were the demonstrations explaining the breeding of a parasite which lays its eggs on the eggs of the two principal caterpillar borers of padi. Cages containing rice and bran in which a common grain moth is bred in order to obtain eggs in which this parasite lays its eggs were on view. The moths were then collected by a magnum vacuum cleaner specially adapted for the purpose. The method employed in gumming the eggs of the moth on cards which were eventually placed in tubes containing the parasites was demonstrated. It was explained that cards containing parasitised eggs were sent daily to the Krian district, and fixed to padi plants in the hope that the emerging parasites would parasitise the eggs of the two principal moth-borers, thereby controlling them. This exhibit created considerable interest.

It was stated that more than 3,000,000 parasites had been liberated on three experimental areas in the Krian in the months of January, February and March, 1930.

An excellent series of paintings of coconuts and padi insects was also shown.

*Rat Pest.*—In order to demonstrate and supply information regarding the best methods of controlling rats, the Field Division staged exhibits of rat-traps and poison-baits and a collection of photographs illustrating the results of rat-drives, trapping and poisoning. The preparation of poison baits was also demonstrated throughout the period of the exhibition and a leaflet describing the various means by which rats could be destroyed was freely distributed.

Other exhibits of interest were live rats in cages with growing padi and oil-palm fruits to show the extensive nature of the damage done by the rodents to these and other local crops.

*Diseases of Oil-Palms, Coconuts and Tea.*—The Mycological Division devoted particular attention to certain diseases of the stem and fruits of oil-palms, which diseases were causing a considerable amount of damage in plantations. Specimens of the stem-rot and the species of fungi which were possible causes of the disease were displayed, as well as harmless species. The fruit diseases due to *Marasmius palmivorus* was shown on non-pollinated bunches and unripe pollinated bunches and on leaf-stalks.

The effect of lightning-strike on coconut palms was illustrated by means of photographs and a section of a struck palm showing the rotted bud.

The fungus *Marasimius palmivorus* was again shown attacking the leaf-stalks of the coconut palm. Coloured drawing of the principal leaf diseases of tea so far discovered. locally were exhibited as well as mounted specimens of diseased leaves

Each exhibit was described fully on large labels which also gave information concerning the methods of controlling the diseases.

*Demonstrations.*—Besides the daily demonstrations given to the general public in connection with certain exhibits, special demonstrations were given

to a large number of delegates and local headmen from different parts of Malaya who were attending a conference of the Rural Co-operative Credit Societies.

In addition, the Government Stock Farm, Serdang exhibited in the Pig Show one Large Black boar, one Large Black sow, one Middle White boar, one Middle White sow and two young Middle White pigs.

*Publications.*—A complete series of publications of the Department was displayed for sale and a leaflet distributed containing full information on publications. The Department's publications are in three languages—English, Malay and Chinese. Officers conversant with these languages were in attendance daily to give information to visitors.

## The Director of Agriculture Visits Kelantan.

The Director of Agriculture was on tour in the State of Kelantan from the 7th to 12th April. On April 9th, he addressed a meeting of the Kelantan Branch of the Incorporated Society of Planters at Kuala Krai on the subjects of the Agricultural Services in Kelantan and the work of the Rubber Research Institute of Malaya in relation to rubber problems in Kelantan.

## Visit of Mr. E. A. Curtler to India and Ceylon.

Mr. E. A. Curtler, Assistant Agriculturist, left Malaya on 19th April, 1930 for Ceylon and India for the purpose of studying tea cultivation as practised in those countries. Mr. Curtler's tour will extend over six months, of which about six weeks will be spent in Ceylon, two to three weeks in Southern India, and the remainder of the time in Assam. He will also give some attention to the cultivation of Arabian coffee in Mysore and will probably visit the hill Station at Ootacamund.

## The Agricultural Chemist Visits New York.

Major C. D. V. George, O.B.E., Agricultural Chemist, visited New York in January, mainly to investigate questions relating to Jelutong, on the invitation of Americans interested in this product of Malaya.

## Headquarters of the Agricultural Field Officer, Perak South.

The headquarters of the Agricultural Field Officer, Perak South, was transferred from Batu Gajah to Tapah on 1st April, 1930.

## Leave.

Mr. G. E. Mann, M.C., Agricultural Instructor (Malay Officers) has been granted eight months and fifteen days leave on full pay, with effect from 2nd May, 1930 inclusive.

Mr. Mann will attend, as a delegate of this Government, the Imperial Entomological Conference to be held in London in June and the Agricultural Congress in Antwerp in July. He will also be on duty at the International Exhibition, Antwerp for one month during his leave.

## Conference of Co-operative Society Delegates.

A conference of Co-operative Society delegates—office bearers in Societies and local headmen—was held at The Malayan Exhibition. His Highness, The Sultan of Selangor opened the conference on Saturday, April 19th. His Highness was followed by the British Advisers of Kedah and Kelantan who addressed the conference in the Malay language. Among those present were the Director of Agriculture, the Director of Co-operation and the Under Secretary to Government.

On Sunday and Monday, parties were conducted through the exhibits staged by the Department of Agriculture and the Rubber Research Institute of Malaya, short lectures in the vernacular being delivered at the various stands by the departmental officers.

The final meeting of the conference was held on Monday at which certain resolutions concerning padi cultivation and other subjects were discussed and adopted.

# MARKET PRICES.

## April, 1930.

*Rubber.*—Rubber was quoted at $7^9/_{16}$ d., London and $25\frac{3}{4}$ cents Singapore per lb., at the beginning of the month. It shewed a slight but steady decline throughout the month, quotations on the last day being $6^{15}/_{16}$ d., London and 23 cents Singapore. The average price for the month was 7.3 pence per lb., London and 24.68 cents per lb., Singapore, compared with 7.6 pence and 25.43 cents for the month of March.

*Copra.*—Copra prices recovered somewhat, closing around $8.80 per picul F.M., and $9.30 S.D. The average prices for the month were F.M., $8.70½ per picul, S.D., $9.17½ per picul against $8.54 and $8.90 respectively in the previous month. The Singapore Chamber of Commerce records transactions amounting to 3,369 tons for the period 24th March to 19th April.

*Gambier.*—Average Singapore prices for April, block $8.76½, cube $18.00 against $8.97 and $15.71 per picul respectively in March. Transactions, 64 tons block, 10 tons cube.

*Nutmegs.*—Average Singapore prices for April: 110 per lb. $34.00 per picul against $35.50 in March; 80 per lb. $37.65 per picul compared with $38.75 for the previous month.

*Pepper.*—Singapore prices averaged $45.00 per picul compared with $47.31 for black, $55.06 against $67.34 for White Sarawak. Transactions, 49 tons black; 140 tons white.

*Rice.*—Singapore average price; Siam, $365.75; Saigon, white, $262.75; Rangoon, white, $244.25—all per coyan. Corresponding average prices in March were $339.50; $247.00; $222.00. It will be seen, therefore that the price of all grades appreciated in price. The average prices in February were —Siam $384.00; Saigon $253.80, Rangoon $239.60.

*Sago.*—Average Singapore prices for April were as follows:—Pearl, fair, $6.50½ (27 tons); Flour, $5.96 (1,821 tons) per picul, compared with $7.03 and $3.92 per picul in March.

*Tapioca.*—Average prices in Singapore; Flake, small, fair $5.32½ (330 tons) against $5.57 per picul in March; Pearl, fair $7.00 per picul (130 tons) compared with $7.47 per picul in March.

The above prices are based on the daily cabled London quotations for rubber and on the Singapore Chamber of Commerce Market Reports covering the period 24th March to 19th April, 1930, and on other local sources of information. The quantities in brackets are the transactions recorded by the Singapore Chamber of Commerce.

1 coyan = 40 piculs 1 picul = $133^1/_3$ lbs.

The dollar has been fixed at 2 shillings and 4 pence

# MALAYA RUBBER STATISTICS.

**Stocks of Rubber including Latex and Revertex held by Dealers and Estates of 100 Acres and Over, together with the Declared Production of the same Estates. Import and Export Figures, and Estimated Figures of the Production of Estates of Less than 100 Acres, for the Month of March, 1930, in Dry Tons.**

| Territory | Stocks at beginning of month | | | Production by estates of 100 acres and over | | Production by estates of less than 100 acres (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ports | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | during the month: Foreign | during the month: From Malay States | during the year 1930: Foreign | during the year 1930: From Malay States | during the month: Foreign | during the month: Local | during the year 1930: Foreign | during the year 1930: Local | Dealers | Estates of 100 acres and over | Ports |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **Malay States** | | | | | | | | | | | | | | | | | | |
| **Federated Malay States** ... ... | ... | 11,941 | 14,338 | 10,926 | 35,603 | 8,271 | 31,091 | Nil | 2 | Nil | 18 | 15,356 | 5,354 | 50,623 | 18,035 | 11,730 | 13,038 | |
| **Johore** ... ... | ... | 2,379 | 5,040 | 3,310 | 10,673 | 3,347 | 12,398 | Nil | 3 | Nil | 3 | 1,226 | 6,222 | 3,158 | 21,232 | 2,151 | 4,480 | |
| **Kedah** ... ... | ... | 359 | 1,878 | 1,727 | 5,673 | 1,182 | 4,267 | Nil | Nil | 2 | Nil | 659 | 2,206 | 2,243 | 8,171 | 420 | 1,863 | |
| **Perlis** ... ... | .. | 28 | 9 | 8 | 26 | 19 | 53 | Nil | Nil | Nil | Nil | Nil | 27 | Nil | 74 | 28 | 9 | |
| **Kelantan** ... ... | ... | 271 | 119 | 120 | 651 | 590 | 1,229 | 4 | Nil | 13 | Nil | 84 | 652 | 219 | 2,009 | 210 | 158 | |
| **Trengganu** ... | ... | ... | ... | ... | ... | ... | ... | Nil | Nil | Nil | Nil | Nil | 236 | Nil | 581 | ... | ... | |
| **Straits Settlements** | | | | | | | | | | | | | | | | | | |
| **Malacca** ... ... | ... | 2,505 | 1,649 | 1,189 | 3,835 | | | Nil | 988 | Nil | 3,195 | 3,373 | | 12,120 | | 2,179 | 1,666 | |
| **Province Wellesley** | ... | 143 | 638 | 392 | 1,466 | | | | | | | | | | | 159 | 505 | |
| **Dindings** ... ... | ... | 94 | 147 | 90 | 290 | 1195 | 7694 | 745 | 3,095 | 2,631 | 10,878 | 5,949 | Nil | 18,577 | Nil | 123 | 134 | |
| **Penang** ... ... | 1,859 | 5,377 | 7 | 8 | 29 | | | | | | | | | | | 5,305 | 8 | 1,404 |
| **Singapore** ... .. | 4,962 | 31,214 | 410 | 226 | 743 | | | 9,804 | 10,610 | 28,736 | 36,016 | 20,801 | | 62,279 | | 31,734 | 345 | 3,662 |

**Analysis of Colony and Federated Malay States Dealers' Stocks at End of Month, in Dry Tons.**

| Class of Rubber | Federated Malay States | Singapore | Penang | Province Wellesley, Dindings and Malacca | Johore | Gross total |
|---|---|---|---|---|---|---|
| (20) | (21) | (22) | (23) | (24) | (25) | (26) |
| Smoked sheet ... | 8,828 | 12,155 | 3,453 | 1,365 | 999 | 26,800 |
| Crepe ... ... | 676 | 16,244 | 1,009 | 779 | 226 | 18,934 |
| Unsmoked sheet ... | 1,019 | 3,335 | 843 | 317 | 926 | 7,647 |
| Scrap and lump ... | 1,207 | | | | | |
| Total all Grades ... | 11,730 | 31,734 | 5,305 | 2,461 | 2,151 | 53,381 |

*Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated April 10. The ratio of the reduction on wet rubber, taken from dealers' returns, is 27.9% for Singapore and 24.9% for Penang.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%.

5. Foreign imports are as published in Return I. & E. 5, dated April 4, reduced to dry weight by the percentages in Note 3 (*S.S. Gazette* Notification No. 719/1930).

6. Foreign exports are those of each State and Settlement as published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I. & E. 4, dated April 5.

7. The State of Trengganu has no organisation at present for the collection of returns of stocks and production; the latter can be estimated as equival nt to exports.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals. The latest publication is therefore always the most reliable.

Kuala Lumpur,
*March, 1930.*

Jno Gordon-Carrie,
*Deputy Registrar-General of Statistics, S.S. and F.M.S.*

# Summary of Padi Report for the Month of February, 1930. (F.M.S. and S.S.)

| State. | Locality | Acreage of Padi Land | | | Acreage planted current season | | | Remarks. |
|---|---|---|---|---|---|---|---|---|
| | | Acres | R. | P. | Acres | R. | P. | |
| S. S. | P. Wellesley | 39,640 | 0 | 00 | 38,120 | 0 | 00 | Age 4 months from date of planting. |
| | Penang | 4,000 | 0 | 00 | 2,842 | 0 | 00 | Age 4 to 5 months. Harvesting Progress. Irrigation available to limited area. Lot of damage by rats and stem borer. Scattered areas about 500 acres not included |
| | Malacca | 35,279 | 0 | 00 | 29,734 | 0 | 00 | Harvesting about completed Prospects are good. |
| | TOTAL:—S.S. | 78,919 | 0 | 00 | 70,696 | 0 | 00 | |
| Perak | North | 82,918 | 0 | 00 | 75,887 | 0 | 00 | Except Bruas District all other districts are very fair Age 4-5 months from date of planting. About 12,807 acres harvest nearly finished, rest progessing. |
| | South | * | | | †2,930 | 0 | 00 | Crop prospect at present very fair. Padi secured in excellent condition as a result of dry weather. |
| | TOTAL:—PERAK | 82,918 | 0 | 00 | 78,817 | 0 | 00 | |
| N. Sembilan | Six Districts | 37,217 | 0 | 15 | 31,405 | 2 | 17 | Prospects good. Dry padi 345 acres. Estimated output about 19603 acres @ 250 gantangs per acre and rest @ 200 g. p. a. |
| Pahang | West | 20,089 | 0 | 00 | 4,079 | 0 | 00 | Raub District. Harvest completed. Total area harvested 4079 acres. Crop harvested Total **1,007,837** gantangs. Remaining areas of Temerloh, Lipis and Bentong Districts off season. Raub District: Dry Padi 120 acres planted and has given estimated yield of 32,600 gantangs. |
| | East | * | | | * | | | |
| Selangor | Five Districts | 22,692 | 0 | 00 | 19,687 | 0 | 00 | Scattered areas in 5 districts = 2500 acres crop harvested on same 61,875 gantangs. Prospects Ulu Langat and Kuala Lumpur districts are fair. Total yield in so far completed areas of the 5 Districts amounting to 1,635,925 gantangs. |

# Summary of Padi Report for the Month of March, 1930.

| State. | Locality. | Acreage of Padi Land. Acre. | R. | P. | Acreage Planted current Season. Acre. | R. | P. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| S.S. | Malacca | 35,299 | 0 | 00 | 29,739 | 0 | 00 | Harvesting completed about 26,293 acres in Alor Gajah, Jasin Coast Mukims, and Central Districts. Prospects of crop on Jasin Central Districts Good. Yield on 14,713 acres =**5,372,940** Gantangs. |
| | Prov: Wellesley | 39,640 | 0 | 00 | 38,120 | 0 | 00 | North and central parts harvesting almost completed. Prospects of crop on these blocks are poor, owing drought during growing period and generally unfavourable weather conditions. Southern part **350** acres Harvesting completed. Very fair Crop. Yield about **450** gantangs per acre about **8900** acres late rains delayed planting, insufficient water, ½ area will give practically no crop. Total yields so far harvested Pro: Wellesley .. **6,216,500** Gantangs. Scattered area .. **500** acres Yield **45,000** Gantangs. Dry Padi .. **350** acres: Crop below average. |
| | Penang | 4,000 | 0 | 00 | 2,842 | 0 | 00 | Harvesting completed. Fair crop. Irrigation available but to limited area. Rats and stem borer caused lot of damage. Total yield ... **1,201,500** Gantangs. |
| | Total, S.S. | 78,939 | 0 | 00 | 70,701 | 0 | 00 | Total Yields S.S. (Including Dry and Scattered areas,) .. **12,835,940** Gantangs. |
| Perak. | North | 82,917 | 0 | 00 | 75,887 | 0 | 00 | Perak North:—Kuala Kurau, crop not up to expectations. Very fair crop reaped in Bagan Tiang, Tanjong Piandang, and Bagan Serai Mukims, Parit Buntar prospects fair. Briah, Selinsing, and Gunong Semanggol late and prospects poor. Larut prospects not good except in Selama and in Batu Kurau. Good average crop reaped in Kuala Kangsar. Upper Perak yield below expectation, and many empty glumes. Areas of Dry Padi 261 Acres:— |
| | South | * | | | 2,930 | 0 | 00 | Perak South. All are scattered areas except 1198 Acres in up River Mukims. Harvesting completed in Taja, Ulu Kinta and Tapah Districts. Total yield in these 3 Districts. = **135,358** Gantangs. Rest of the areas Harvesting progress and commencing. Total Dry Padi =**5,750** acres of which 1,708 acres in Tapah yielded **295,147** Gantangs. |
| | Total, Perak | 82,917 | 0 | 00 | 78,817 | 0 | 00 | |

* Not known.

| State. | Locality. | Acreage of Padi Land. | | | Acreage Planted current Season. | | | Remarks. |
|---|---|---|---|---|---|---|---|---|
| | | Acre. | R. | P. | Acre. | R. | P. | |
| N.S. | Six Districts - | 37,217 | 0 | 05 | 31,405 | 2 | 17 | Harvesting completed in all Districts. Total yield Harvested in N.S = 8,149,670 Gantangs. |
| Selangor. | Six Districts - | 22,692 | 0 | 00 | 19,687 | 0 | 00 | Harvesting completed in Ulu Langat, Kuala Lumpur and Ulu Selangor Districts in February. About 18,000 acres in Kuala Selangor Harvesting commenced. Scattered areas 2,520 acres. Yield on 945 acres = 61,375 Gantangs. Damage by Pests and lack of water in the areas north of Selangor River indicates a poor harvest in K. Selangor District. |
| | Total, Selangor- | 22,692 | 0 | 00 | 19,687 | 0 | 00 | |
| Pahang. | West - | 12,311 | 0 | 00 | ... | ... | ... | Temerloh District 12,311 acres established nurseries. Lipis, Raub and Bentong off Season. |
| | East* - | | | | | | | * Returns by Quarterly. |
| | Perak - | 82,917 | 0 | 00 | 78,817 | 0 | 00 | |
| | Selangor - | 22,692 | 0 | 00 | 19,687 | 0 | 00 | |
| | Negri Sembilan- | 37,217 | 0 | 00 | 31,405 | 2 | 17 | |
| | Pahang - | ... | ... | ... | ... | ... | ... | |
| | Total, F.M.S. - | 142,826 | 0 | 00 | 129,909 | 2 | 17 | |
| | Total, S.S - | 78,939 | 0 | 00 | 70,701 | 0 | 00 | |

# METEOROLOGICAL SUMMARY, MALAYA.

## MARCH, 1930.

**Air Temperature in degrees Fahrenheit**

| Locality | Means of A. Max. | Means of B. Min. | Mean of A and B | Absolute Extremes: Highest Max. | Date | Lowest Min. | Date | Lowest Max. | Date | Highest Min. | Date |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | °F | °F | | °F | | °F | | °F | |
| Railway Hill, Kuala Lumpur, Selangor ... | 93,3 | 73,4 | 83,3 | 97 | 5, 20 | 71 | 24th | 88 | 14th | 75 | Several |
| Bukit Jeram, Selangor ... | 92,2 | 73,2 | 82,7 | 96 | 27th | 71 | 27th | 89 | 13, 15 | 72 | „ |
| Temerloh, Pahang ... | 91,4 | 72,6 | 82,0 | 97 | 5, 29 | 70 | 3rd | 77 | 13th | 76 | 6th |
| Kuala Lipis, Pahang .. | 89,5 | 72,5 | 81,0 | 94 | 5, 29 | 70 | 8, 12 | 76 | 13th | 75 | 6th |
| Kuala Pahang, Pahang ... | 86,1 | 77,0 | 81,5 | 89 | Several | 72 | 14th | 75 | 13th | 81 | Several |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 72,8 | 59,7 | 66,3 | 78 | 4, 5 | 56 | 8th | 66 | 9th | 61 | „ |
| Cameron's Highlands, Tanah Rata ... | 72,9 | 56,3 | 64,6 | 76 | 20, 21 | 49 | 4,31 | 68 | 9th | 63 | 7th |
| Fraser's Hill, Pahang ... | 72,3 | 62,3 | 67,3 | 77 | 18, 29 | 60 | 8, 12 | 66 | 13th | 65 | 6th |
| Mount Faber, Singapore ... | 86,9 | 73,8 | 80,3 | 90 | Several | 71 | 10th | 78 | 13, 14 | 75 | Several |
| Bukit China, Malacca ... | 85,1 | 74,5 | 79,8 | 92 | 1, 30 | 72 | 8, 14, 17 | 82 | 14th | 77 | 1, 27, 28, 30 |
| Kluang, Johore ... | 89,2 | 72,7 | 80,9 | 93 | Several | 69 | 9th | 78 | 10th | 75 | 19, 20 |
| Bukit Lalang, Mersing, Johore ... | 84,8 | 73,5 | 79,1 | 87 | Several | 70 | Several | 78 | 10th | 79 | 20, 21 |
| Alor Star, Kedah ... | 93,2 | 73,2 | 83,2 | 97 | 1st | 69 | 10, 13 | 87 | 14th | 76 | 16th |
| Kota Bharu, Kelantan ... | 87,3 | 72,7 | 80,0 | 90 | Several | 69 | 4th | 83 | 17th | 76 | Several |
| Kuala Trengganu, Trengganu ... | 86,4 | 74,0 | 80,2 | 89 | 6, 7, 31 | 71 | 4th | 83 | 18th | 79 | 8th |

**Earth Temperature, Rainfall, Number of Days, Bright Sunshine**

| Locality | Earth Temperature: At 1 foot | At 4 feet | Rainfall: Total | Total | Most in a day: Amt. | Date | Number of Days: Precipitation | Precipitation, 1mm. or more | Thunderstorm | Thunder heard | Fog morning obs. | Gale force 8 or more | Bright Sunshine: Total | Daily Mean | Length of Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | in. | mm. | in. | | | | | | | | hr. | hr. | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 84,2 | 84,3 | 6,51 | 165.4 | 1,87 | 12th | 14 | 11 | 6 | 14 | 3 | | 210,30 | 6,78 | |
| Bukit Jeram, Selangor ... | 88,1 | 88,8 | 2,02 | 51,3 | 0,48 | 7th | 13 | 11 | ... | 21 | 1 | | 259,25 | 8,36 | |
| Temerloh, Pahang ... | 85,8 | 85,8 | 2,72 | 69,1 | 0,90 | 11th | 12 | 8 | 2 | 12 | 6 | | 193,85 | 6,25 | |
| Kuala Lipis, Pahang .. | 83,1 | 82,6 | 4.28 | 108,7 | 0,93 | 7th | 14 | 13 | 3 | 12 | 15 | | 187,65 | 6,05 | |
| Kuala Pahang, Pahang ... | 85,3 | 85,0 | 12,04 | 305,8 | 5,38 | 13th | 16 | 12 | ... | 2 | ... | | 246,00 | 79,4 | |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | ... | ... | 4,86 | 123,5 | 1,23 | 23rd | 22 | 20 | 2 | 19 | 1 | | 164,75 | 5,31 | |
| Cameron's Highlands, Tanah Rata ... | 68.7 | 68,5 | 4.61 | 117,1 | 1,20 | 23rd | 22 | 18 | 2 | 19 | 1 | | 147,90 | 4,77 | |
| Fraser's Hill, Pahang ... | 71,7 | 71,5 | 5,92 | 150,4 | 1,57 | 5th | 21 | 19 | 4 | 23 | 9 | | 138,70 | 4,47 | |
| Mount Faber, Singapore ... | 81,4 | 82,5 | 7,37 | 187,2 | 2,27 | 16th | 13 | 10 | ... | 15 | ... | | 211,80 | 6,83 | |
| Bukit China, Malacca ... | 83,3 | 86,8 | 9,72 | 246,9 | 3,21 | 23rd | 15 | 12 | 4 | 12 | ... | | 222,55 | 7,17 | 11,10 |
| Kluang, Johore ... | 82,8 | 82,5 | 3,77 | 95,8 | 0,85 | 11th | 14 | 10 | ... | 9 | 1 | | 206,40 | 6,65 | |
| Bukit Lalang, Mersing, Johore ... | 81.2 | 80,7 | 8,13 | 206,5 | 2,14 | ... | ... | ... | ... | 5 | 3 | | 234,85 | 7,58 | |
| Alor Star, Kedah ... | 86,2 | 86,5 | 7,06 | 179,3 | 1,93 | 27th | 2 | 11 | 4 | 19 | .. | 1 | 250,40 | 8,07 | |
| Kota Bharu, Kelantan ... | 82,3 | 82,8 | 5,37 | 136,4 | 1,17 | 16th | 14 | 11 | ... | 2 | .. | | 237,65 | 7,67 | |
| Kuala Trengganu, Trengganu ... | 82,8 | 83,2 | 5,98 | 151,90 | 1,58 | 13th | 14 | 10 | 1 | 1 | 6 | | 253,80 | 8,19 | |

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

# Malayan Agricultural Journal.

Vol. XVIII. JUNE 1930. No. 6.

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# THE

# Malayan Agricultural Journal

## JUNE 1930.

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## EDITORIAL.

**Agricultural Shows and Exhibitions.**

The Seventh Malayan Exhibition, held at Kuala Lumpur last month prompts one to a consideration of the scope and utility of agricultural shows and exhibitions.

An Exhibition infers that several branches of a dissimilar nature are grouped around a central idea; whereas a Show is a competition in the various classes grouped in a schedule. Therefore, while the latter aims at stimulating improvements by fostering the competitive spirit, the former attempts to instruct in all branches, to demonstrate the most recent advances and encourage their ready adoption.

The Malayan Exhibition is organised by the Malayan Agri-Horticultural Association, and it is therefore assumed that the object of their annual exhibition is not merely to foster the competitive spirit, but to bring to one centre the various factors affecting the progress of agriculture in this country.

Of paramount importance in the development of agriculture in Malaya is the question of health, for without maintaining the health of the agricultural community the development of new land is impossible. It was therefore satisfactory to note that the Public Health Education Committee established a permanent building, containing a mass of material to demonstrate the essential facts concerning health, all effectively labelled in more than one language; and that they gave frequent demonstrations. The crowds of spectators visiting this Section is evidence of the interest which it commanded.

The Department of Agriculture and the Rubber Research Institute of Malaya shewed a proper appreciation of the situation; by means of well staged and labelled exhibits and of pamphlets printed in the English, Malay, Chinese and Tamil languages, they were able to give the spectators something useful to take away after hearing the short lectures delivered at frequent intervals throughout the day.

The other important Section was that of Village Industries. The Association has rightly insisted that all exhibits in this Section should be for sale. The sales are organised by the Association and the proceeds sent to the owners.

Many of these owners live far from large centres of population and they therefore appreciate the fact that a market for their goods is being provided through the medium of these Exhibitions. We have stated that this section is an important one. Village agriculture consists mainly in rice, rubber and coconut production, which generally do not fill the time of the owner throughout the year, or throughout the day. The existence of means of supplementing his income is therefore frequently welcome to the cultivator and is not an insignificant factor towards making life in the village more attractive. Any means that can be devised to persuade the agriculturist to remain on the land is worthy of encouragement and it is for this reason that we regard village industries as important.

Less worthy of favourable comment were the agricultural exhibits submitted for competition. The exhibits of rubber and coconut products were very disappointing, both in quantity and quality and we doubt whether the native agricultural industries were sufficiently representative. These sections require the careful consideration of the organisers before the next Exhibition.

The inclusion of a Trade Section is of value in demonstrating the relationship of engineering to agriculture.

The Exhibition was well conceived, and organised. Its most important features were distinctly educational and its range such as to be attractive to all conditions of visitors.

**Pepper.**

Attention is directed to the article which appears in this number of *The Malayan Agricultural Journal* on Pepper Cultivation in Malaya by Mr. J. N. Milsum. The article proves that pepper can be successfully cultivated in Malaya. While there is no scope for the cultivation of this product as a major crop, it is rather amazing to find there are no areas under pepper in Malaya. One of the difficulties in exploiting a crop not usually cultivated in a particular country is that of finding an established market. This does not apply to pepper, for there is a long-established market for it in Singapore. The Singapore trade in 1929 dealt with between 12,000 to 13,000 tons of pepper valued at about $17,500,000.

**Insect Pests of Padi.**

A preliminary general account is given in this number of the *Malayan Agricultural Journal* of the principal insect pests attacking padi. The need for greater attention to the production of rice in the Peninsula and for the enhancement of returns from padi areas, calls for increased attention to all factors likely to reduce the size of the crop, and in this connection damage caused by insect pests is of importance.

It is well that it should be realised that padi is a crop which is subject to depredation by a large number of insect pests, and there is little doubt that in the aggregate, they are responsible for considerable reduction in crop; while as padi is grown entirely as a native crop such depredations may frequently escape unnoticed until the damage becomes very serious.

Particular interest centres in the attempts now being made by the Entomological Division to control attacks of padi borers by means of the systematic breeding of the egg parasite *Trichogramma* sp. A preliminary account of this work is given in the article in question, and while it is as yet too early to express an opinion as to the probable success which may be achieved, the effort is worthy of notice.

**Secondary Leaf-fall of Rubber.**

Attention is invited to a short abstract to be found elsewhere in this number, of a report by Mr. Beeley of the Rubber Research Institute of Malaya on the general occurrence in the Southern half of the Peninsula of the fungus known as *Oidium Heveae* which causes secondary leaf-fall. With a view to determining the extent and spread of infection, this fungus has now been included as a notifiable pest in the schedule attached to the Pest Notification Rules 1925 under the Agricultural Pests Enactment and Ordinance No. 166 (Agricultural Pests).

**Locusts.**

On May 17th, 1930, a report was received from the Agricultural Field Officer, Negri Sembilan, that a somewhat small and scattered swarm of locusts had been found in a patch of lalang about 14 acres in extent situated about 2 miles from the Tampin Gemas road to the north of 7½ mile stone. Comparison of these insects with specimens in the entomological collection of the Department and with published descriptions left little room for doubt that they were the same locusts, *Locusta migratvria,* which were present in large numbers in Selangor, Negri Sembilan, Malacca and Northern Johore during the years 1913 to 1918. Recent researches show that this insect normally lives as a solitary grasshopper, but that after a number of generations, individuals collect into small rather loosely gregarious swarms which in turn give rise to much larger and migratory swarms of true locusts. The insects found in Negri Sembilan are believed to be in the congregating phase which precedes the formation of large swarms. Consequently, it is important to destroy them in their present phase before their offspring have given rise to large and destructive swarms. There is a possibility that other similar swarms will assemble during the next few months in open grasslands, especially the less frequented 'lalang' grass areas near the Negri Sembilan—Malacca—Johore boundaries, and the Department is anxious to obtain reports of any swarms or suspected swarms of locusts that may be observed, so that measures can be employed promptly to destroy them.

# ORIGINAL ARTICLES.

## PEPPER IN MALAYA.

BY

J. N. Milsum,
*Assistant Agriculturist.*

### Introductory.

It is proposed in the following paper to present in a concise form, the main facts known regarding the cultivation of pepper, *Piper nigrum*, L. in this country. A considerable amount of information exists, scattered in various publications, since the production of pepper is closely associated with the early development of the older Settlements. The most complete account of this important spice is to be found in "Spices" by H. N. Ridley (1912), page 239. It is evident, however, that there are a number of important points regarding the behaviour and cultivation of pepper locally that require elucidation. It is hoped that more complete information will be available in the near future as the experimental cultivation of this crop is receiving the attention of the Department of Agriculture.

### History.

The pepper plant appears to be indigenous to the Malabar Coast of Southern India. From early times, until the fifteenth century, the majority of pepper marketed was produced on the West Coast of India. The arrival of the Portuguese in India in 1498 resulted in the gradual spread of pepper cultivation to the islands of the Malay Archipelago and by the seventeenth century Malacca had become an important centre for the trade in this spice.

The introduction of the pepper plant into Penang is credited to Capt. Francis Light, who is stated to have obtained the plant from Sumatra in 1790. For the next decade pepper was the most important crop cultivated on the Island, but in 1802, when cloves and nutmegs were introduced from the Moluccas, less attention was given to it.

After the founding of Singapore about 1822, the cultivation of pepper was undertaken by Chinese, both in Singapore and Johore. Ridley states that the Chinese combined its cultivation with that of gambier until about 1894, when for several reasons the plantations gradually died out. In 1910, pepper was fairly extensively grown in Johore and then showed signs of increasing. This

Ripe Pepper Berries.
(*Piper nigrum*).

expectation does not appear to have been realized, however, and is hardly to be wondered at considering the rapid strides of rubber planting by Chinese cultivators since that date.

During recent years very little pepper has been grown in the Malay Peninsula, though Singapore has been an important market for the spice. On the other hand, the pepper industry in certain other countries in the Malay Archipelago, notably the Netherlands East Indies and Sarawak, has been of considerable importance. In Sarawak, exports of this spice in 1906 amounted to 90,477 piculs (1 picul = 133⅓ lbs.) valued at $2,394,278 (Straits currency). After 1906, exports declined owing to the disease known as "Black Fruit" Disease of Pepper (*Cephaleuros mycoidea*), resulting in many pepper gardens being abandoned. In 1920, the exports of pepper had fallen to 18,031 piculs valued at $712,122.

## The Local Market.

As already stated, Singapore, and to a lesser extent Penang, are important markets for the collection and export of pepper. The table on page 275 compiled from official returns shows the trade in this spice during the periods 1925—1929.

The following table gives the average prices for black and white pepper at Singapore for the period 1925—1929:—

TABLE I.

| | Black. | | White Sarawak. | |
|---|---|---|---|---|
| | $ c. | | $ c. | |
| 1925 | 31.08 | per picul | 51.26 | per picul |
| 1926 | 43.81 | ,, | 68.36 | ,, |
| 1927 | 53.77 | ,, | 91.10 | ,, |
| 1928 | 66.27 | ,, | 98.56 | ,, |
| 1929 | 57.88 | ,, | 103.73 | ,, |

1 picul = 133⅓ lbs.

Owing to the very marked increase in the value of pepper during the last few years, renewed interest has been taken in the possibilities of pepper production. The present Singapore market prices (May, 1930) are quoted as $50/- per picul for white pepper and $37/- for black pepper. This represents an increase in value of over 100 per cent. to the price ruling during the latter part of 1923. It must be appreciated, however, that the market for this spice is limited and increased production, as a result of the high prices ruling, are likely to cause a fall in values. It is a matter for conjecture as to what extent increased production will reach, having in mind the difficulty in obtaining suitable land in Malaya and the ravages of "Black Fruit" disease in Sarawak. It is evident that renewed interest in pepper cultivation is being taken in Ceylon and the West Coast of India.

## TABLE II.

**Imports and Exports of Pepper from Malaya.**

| Year | Imports. | | | | | | Exports. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Black | | White | | Total Pepper | | Black | | White | | Total Pepper | |
| | Tons | Value $ | Tons | Value $ | Tons | Value $ | Tons | Value $ | Tons | Value $ | Tons | Value. $ |
| 1925 | 8,767.25 | 4,401,866 | 5,255.71 | 4,851,741 | 14.022.96 | 9,253,607 | 7,338.01 | 3,426,196 | 8,210.30 | 6,561,877 | 15,548.31 | 9,988,073 |
| 1926 | 9,679.01 | 6,779,790 | 4,388.74 | 5,126,214 | 11,067.75 | 13,906,004 | 8,013.01 | 5,854.844 | 6,183.40 | 7,131,634 | 14,196.41 | 12,986,478 |
| 1927 | 6,139.28 | 5,781,855 | 5,572.43 | 9,020,193 | 11,721.71 | 14,802,048 | 6,376.51 | 5,892,836 | 6,897.83 | 10,597,938 | 13,274.34 | 16,490,774 |
| 1928 | 6,918 | 7,385,903 | 5,586 | 8,787,594 | 12,504 | 16,173,497 | 5,962 | 6,435,923 | 7,300 | 11,711,059 | 13,262 | 18,146,982 |
| 1929 | 7,341 | 7,474,383 | 6,397 | 10,418,832 | 13,738 | 17,893,215 | 5,656 | 5,537,532 | 7,009 | 11,928,970 | 12,665 | 17,466,502 |

## Description.

Black pepper is the dried fruit of *Piper nigrum* L. belonging to the Natural Order *Piperaceae*. The plant is a large woody climber but under cultivation its growth is restricted. The flowering catkins are from 1 to 6 inches long and ½ inch in diameter, each bearing about 60 pepper corns when mature. It is stated that in the wild forms the plant is unisexual, i.e., having male and female catkins on separate vines. In the cultivated plant, however, male and female flowers are usually produced in the same catkin. The berries are a dull green colour turning red as they ripen. Beneath the red skin is a thin layer of pulp which encloses the round white seed.

The vernacular names for this spice is "lada" Malay, and "molagu" Tamil.

## Varieties.

Ridley states that the pepper cultivated in the Malay Peninsula is of one variety only. From recent observations made by the writer this appears to be true at the present time. Sumatra Malays, who cultivate this crop, appear to have no knowledge of distinguishable forms occurring locally. The local form produces hermaphrodite catkins, i.e., male and female flowers intermixed on the same spike, and for this reason are heavy fruiters. The fruits contain large seeds and yield white pepper corns of good quality.

Recognisable varieties are, however, recorded from Sumatra, Siam and the West Coast of India. These varieties differ in habit, shade requirements, fruiting season, size of spike and berry, and degree of pungency of the prepared pepper corn. It is not proposed in this paper to record the descriptions of these forms since a detailed study of the subject is desirable before a true idea of their value under local conditions may be obtained. Ridley refers to three varieties mentioned as occurring in Sumatra namely, "lada kawur", "lada manna", and "lada jambi". Trang pepper is grown in the Siamese State of that name. According to Bulletin No. 98, "Pepper Cultivation on the West Coast," published in 1929, by the Department of Agriculture, Madras, several varieties are cultivated on the West Coast of India. These are as follows:—Kalluvelli, Balankotta, Uthirankotta, and Cheriakoti. Of the first three varieties, Kalluvelli is shown as the best yielder. Sub-varieties occur, but these are mostly of inferior value.

## Soils and Situation.

The pepper plant grows naturally in the decaying leaf-mould formed in forests. Under cultivation it will grow in a variety of soils but, where humus is absent, manuring with burnt earth or wood-ashes is essential to secure satisfactory results. It appears to thrive better on flat land than on the slopes of hills, probably owing to the fertility of flat land being less affected by erosion than in the case of sloping land. In the past, pepper has been grown successfully on stiff yellow clay soils in Malaya, but the fertility of the soil was maintained by continuous application of burnt earth and wood ashes.

## Propagation.

Propagation of the pepper vine is usually undertaken from cuttings, though it may be raised from seed.

*Cultivation from seed.*—Detailed information regarding the behaviour of pepper raised from seed is not available. It is stated that in Ceylon at least eighteen months must elapse before seedlings are ready for removal from the seed nursery to the field (Department of Agriculture, Ceylon; Leaflet No. 53).

Seed collected locally and sown in boxes at the Experimental Plantation, Kuala Lumpur, gave 90 per cent. germination. In three months time from sowing, many of the seedlings reached a height of eight inches and were sufficiently large to plant out. When dealing with seedlings on a large scale in nursery beds it is probable that a greater length of time must be allowed before the young plants would be ready for removal. Ridley (l.c.) mentions two main objections to employing seedlings namely, the possibility of not coming true to type and length of time before vines commence to fruit. It is, therefore, desirable to employ cuttings in preference to seed when the former are available.

*Cuttings.*—Strong cuttings, 1 to 2 feet long, with lateral branches, taken from the upper part of bearing vines should be used. Smaller cuttings will grow but take longer to become established. Cuttings from the runners of the previous season's growth, growing from the base of the vines, are used in India. The base of the cutting should be cut clean below the node.

Since pepper cuttings are very liable to dry out if exposed to sunlight, care is necessary to keep them in fresh condition after they are removed from the parent vines.

The most satisfactory method of raising plants from cuttings is by planting them in nursery beds. Cuttings planted direct in the field, unless conditions are very favourable, frequently die or fail to grow for many months. Malay cultivators ordinarily place the cuttings in shallow trenches, covered with a coconut palm leaf, under the shade of fruit trees. The cuttings sprout in about three months and are then lifted during rainy weather. Nursery beds should be in a sheltered situation with good drainage. The ground is well dug and made into raised beds, and shaded with palm leaves, placed on poles, about 5 feet from the ground. In dry weather frequent watering is necessary, since the cuttings require a damp atmosphere.

## Shade and Supports.

Pepper plants are either allowed to grow up living trees or else hard-wood posts are provided. The latter method is commonly undertaken in the Malay Archipelago.

In India and Ceylon, living standards are used. The most common trees planted being dadaps (*Erythrina indica* and *E. lithosperma*), kapok (*Ceiba pentandra*), Jack fruit, Mango and *Morinda tinctoria.* The tree selected for this purpose should be quick-growing, deep-rooting, able to withstand heavy

Mature Pepper Vine (*Piper nigrum*),
at Cheras, Selangor.

pruning, and, preferably leguminous. When dadaps are used they are generally planted about 7 feet apart. The use of living trees as supports in Malaya is not recommended. More satisfactory results are obtained by using stout hard-wood posts. The posts should not be less than 6 inches through and about 14 feet long, thus allowing 10 feet above the soil. The spacing allowed between the posts is usually from 6 to 7 feet.

In the Netherlands East Indies, where special attention is given to the crops, stone pillars are sometimes used as supports.

It is obvious that the supply of suitable supports is a necessary concomitant to the successful cultivation of pepper on a large scale.

Though the pepper plant occurs wild in dense jungle, under cultivation shade is not essential and is not employed in the pepper gardens of Sarawak and Sumatra. During the early stages of the plant's growth, a few trees in the vicinity of the pepper garden appear advantageous, but the plants are quite amenable to full sunshine in the humid atmosphere of Malaya.

## Cultivation.

When the cuttings are ready for transplanting, they are lifted from the nursery beds and planted a few inches away from the supports, facing east. Several cuttings may be planted against each support. Planting should be undertaken during damp or rainy weather and the young plants shaded from the sun by fern fronds or branches of trees. As the vine ascends, it is tied to the post with twine and on reaching the top, it is usually pulled down and wound round the base of the support. Periodical pruning is necessary to prevent the plant from growing bushy at the top. When the vine is a year old, heavy pruning is often undertaken and the cuttings employed as further stock. The object of the cultivation is to promote branching so that the upper plant covers the support with a dense mass of stems and fruiting branches. The vine takes from three to four years to cover the post, and may then be considered full grown. During this period, pruning, removal of early flower spikes, weeding and manuring is undertaken.

## Manuring.

Various forms of manuring are employed by native cultivators, principally the use of burnt earth and wood-ashes, and dried fish refuse. The use of burnt earth as a manure for pepper was commonly practised in the Straits Settlements in the past and is considered of primary importance in the cultivation of this crop in Sarawak. Bushes, branches of trees and other vegetable matter are collected and heaped and partially sun-dried. Soil is then added until the whole forms a large heap. The wood is then ignited and the heap allowed to burn. The resulting burnt earth and wood-ashes are then applied to the base of the pepper plant several times during the year. It appears evident that the potash salts derived from the burnt vegetation forms a suitable food supply to the pepper vine. The use of artificial manures, rich in potash, might prove success-

ful in pepper cultivation and merits trial. On the West Coast of India, fish guano at the rate of ½ to 1 lb. per vine, and 1 lb. of lime mixed with 20 lbs. of leaf-mould per vine, is recommended (Bulletin No. 98, Agricultural Department, Madras).

## Yields.

The vines commence fruiting as early as a year after planting, but fruits should not be allowed to develop until the plant is fully grown, which will be about the third or fourth year after planting. There are generally two crops per annum, one in August/September and the other in March/April, but cropping often continues throughout the year. The vines are considered to be in full bearing at the seventh year and under favourable conditions, will continue to yield good crops for 12 to 15 years.

During the first cropping year, a yield of about 1 lb. of dry pepper per vine is obtained. After the seventh year, an annual yield of 3 to 3½ lbs. of dry pepper per vine is obtained which, with 880 vines to the acre, approximates to 2,500 to 3,000 lbs. of dry pepper per acre per annum.

## Preparation.

The fruits turn yellow and finally red when ripe. After a few berries have ripened the whole spike may be plucked. The berries are detached from the spikes by beating with short sticks or rubbed off by hand.

Black pepper consists of the ground whole, dried berries, i.e. the undecorticated fruit. This form of pepper is obtained by simply drying the berries on mats in the sun. The quality of the pepper can be improved considerably by plunging the berries into boiling water for 10 minutes before drying. Boiling results in the skin of the berries turning black rapidly and accelerates the drying process which is complete in 3—4 days. When large quantities of berries are dealt with, drying rooms with artificial heat are employed.

White pepper consists of the fully ripened berries, deprived of their black skin before grinding. The skins are removed by softening the pulpy covering. This is done by keeping the berries in moist heaps or in sacks in running water. The stalks and pulp are separated by washing in baskets. The pepper corns are then removed and placed on mats to dry in the sun.

## Disease.

A serious disease of pepper berries, known as "Black Fruit" caused by the parasitic alga, *Cephaleuros mycoidea*, has resulted in very serious losses to pepper cultivation in Sarawak. A report on this subject was published in the "Malayan Agricultural Journal," Vol. XI, page 120, as a result of a visit to Sarawak in 1922, by the Mycologist of the Department of Agriculture, S.S. & F.M.S. The disease, however, appears to be the result of abandoned cultivation and is less likely to be of serious consideration where judicious cultural methods are undertaken. The possibility of the disease occurring on pepper in Malaya must not, however, be overlooked.

# BALED COPRA.

BY

C. D. V. GEORGI,
*Acting Agricultural Chemist*

and

F. C. COOKE,
*Assistant Chemist for Copra Investigations.*

## Introduction.

The usual method of packing copra is to suspend an open sack from the roof of the copra store and to compress the contents by means of heavy poles used as rams. By this method, two coolies can fill ten bags, each containing a picul of copra in one hour. For shipment to Europe, new bags costing 50 cents each are frequently employed, having a capacity of between 133 lbs. and 2 cwts., while second-hand bags are almost invariably used for the local sale of copra.

## The Proposal to Bale Copra.

It has been suggested that the effective space, occupied on ships and in godowns by a ton of copra, can be reduced, and pilferage controlled by packing well-dried, good quality copra in the form of compressed, oblong blocks of uniform size and shape, and weighing two cwts. each. Such bales can be handled, stacked and checked easily and well, and, provided that the moisture content of the material was less than 7%, resistance to mould growth, to the development of acid and rancidity and to insect attack would possibly be greater, than when copra is packed in sacks.

## Description of Plant and Process.

As is the usual practice with "mixed" copra for export, the copra is first sorted to remove bad pieces of "F.M." (fair-merchantable) quality. The good copra of F.M.S. (fair-merchantable-sundried) quality is chopped by women to give eight pieces per nut. This sizing which assists compression of the bale and ensures a cohesive block, could alternatively be done in a turnip cutter.

The practice of chopping after drying is already practised on some estates, and serves to ensure a product of uniform and convenient size; to improve the

appearance of the copra; to prevent the accidental inclusion of dirt, foreign matter and pieces of second quality copra; to assist further drying; and also to ensure that the copra makes a close and tight pack. On the other hand it might be better to chop the copra in the half dried condition, when it is being removed from the shell; if this is done, the cut surfaces will seal up in later stages of drying and the rate of drying will be further accelerated and more uniform drying assured.

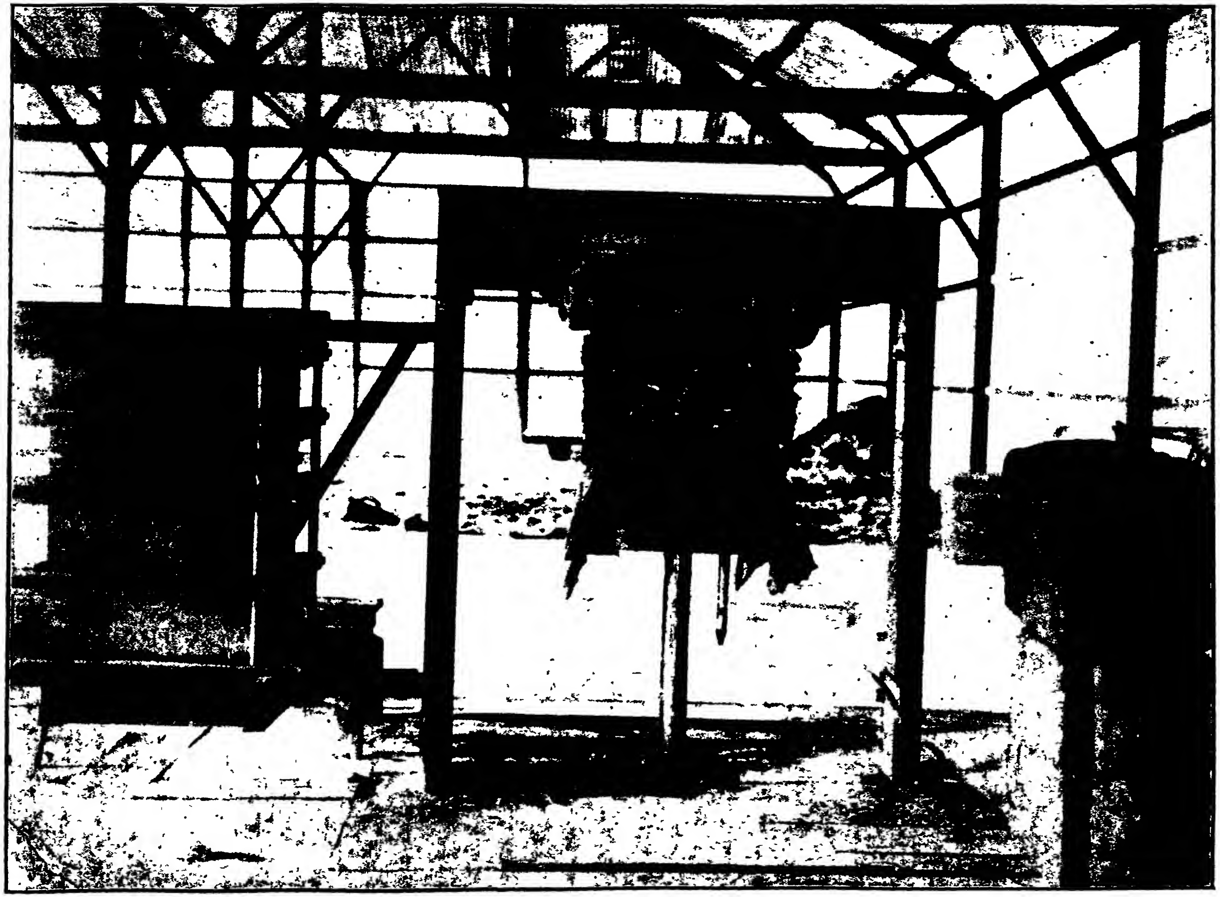
The following is a description of a baling press which is in operation in Selangor:—

The baling machine consists essentially of a long steel box, 4′ high, with two fixed sides and two hinged sides, and capable of being swung as a whole on a vertical shaft. All the sides are reinforced by strengthening girders, and secured in position by a rapid acting clamping device. The top and bottom of this box consists of two removable, grooved, wooden plates or "platens", strengthened and backed with steel, and making a close, sliding fit with the vertical sides. These "platens" are removed from the machine, and two new pieces of Hessian cloth (40″ x 48″) which will ultimately cover the bale are laid over them, and secured in position. The top "platen" is then fitted to the underside of a stout cross-arm, supported on two vertical joists immediately over the hydraulic ram-head; and the bottom plate is placed in position in a recess at the bottom of the box which is thereupon closed securely by the clamps.

The power to work the hydraulic ram is obtained from a 10 h.p. Tangye engine through a counter shaft, the pressure being applied and controlled by a simple arrangement of levers.

Two cwts. of the chopped copra are emptied into the box and levelled up. The filled box is then swung smoothly into position over the ram head and immediately under the top "platen" suspended from the cross arm. A pressure of 28 tons is slowly applied, until the copra ceases to compress, through the ram head to the underside of the lower platen, the area of which is 384 sq. inches. The effective pressure on the copra during a compression period lasting 40 seconds, is thus 1.5 cwts. per square inch.

When the limit of compression at this pressure has been reached, the ram is locked in this top position, and the clamps securing the box quickly released. The whole cage then swings clear of the bale, back to its original position, where it is recharged. The bale remains held in position between the two "platens" by the locked ram head, and the copra is thus exposed to view, a solid oblong block, with not a trace of oil exuding from it. The Hessian cloths are loosened from the "platens", and roughly "stabbed" into position over the block of copra. Three "Safe-seal" wires are next passed through the grooves in the "platens" so as to encircle the bale and they are separately tightened and sealed by a portable "Griplock" sealing machine. The ram is now released, and the bale trucked away for sewing.



Copra Baling Press.

## Working Details.

| | Baling Process | Bagging Process. |
|---|---|---|
| Maximum throughput of Process - | 17 bales per hour or 34 cwts. per hour | 10 bags per hour or 12 cwts. per hour. |
| Time for one complete bale or bag | 6 minutes | 6 minutes |
| Weight of packing - | 4 lbs to 2 cwts of copra | 2 lbs to 1 picul of copra equivalent to 4 lbs to $2\frac{1}{3}$ cwts. |
| Cost of packing materials - | 45 cents a bale or 23 cents a cwt. | 50 cents a bag or 38 cents a cwt. |
| Pressure applied at ram - | = 28 tons | |
| Pressure on the bale - | = 1.5 cwts. per square inch | |

It is not possible to give details of the labour requirements until the present plant is on a full-time regular production.

### The Bale.

The finished bale is a very neat oblong block of a convenient size and shape to handle. Four pieces of split bamboo which are inserted with the Hessian cloth under the wires, serve to keep the bale rigid and compact, and prevent the wire cutting into the copra and so loosening during the vibrations of transport.

The volume occupied by the two cwts. of baled copra is under 5.3 cubic feet, as against 8.3 cubic feet for the same weight of copra in sacks, and the overall dimensions of the bale are $25\frac{1}{4}'' \times 17'' \times 21''$.

The bales pack very neatly and squarely; 84 bales arranged in a stack, 7 high, 4 wide and 3 deep, occupy 49 cubic feet ($12'\ 7'' \times 9'\ 3'' \times 4'\ 2''$). Thus the "broken stowage" for 100 bales (10 tons 4 cwts. in weight with packing) will be 58 cubic feet. At present, because it is a bulky commodity, 12 cwts. of bagged copra are charged freight, as though they weighed a ton, whereas if the copra were baled, a ton of copra could be freighted as such without correction, and 8 cwts. stowage could be saved.

## Possible Oil Loss during Baling and Shipment.

(a) By compression.—Although the pressure is gradually applied to the loose copra and is only of 40 seconds duration, it might be thought that oil would be lost. There is however no sign of loss of oil, nor darkening of the floor immediately underneath the press, and if the hand is rubbed over the exposed block of compressed copra, it will be found to show no trace of exuded oil.

The bale of copra is wired and left in compression, so that the pressure is maintained, until the block is broken up. It could be argued, therefore, that the vibrations and shocks of transport might cause oil to exude and be absorbed in the Hessian covering material. There is, however, no loss of oil on this account.

(b) By self-heating.—In a single bale of copra, the facilities for heat escape may be worse than from the centre of a bag of loose copra. It is almost certain however that a stack of bales is better ventilated than a stack of bags because of the straight channels and connected air gaps which must separate each bale and allow free passage of the cooling air. In a heap of bags, the air spaces which exist inside are generally sealed at some point by the weight of superimposed copra.

When copra deteriorates, heat is liberated and, under the conditions existing in a stack of sacks in the hold of a ship, is accumulated to the further deteriment of the copra and the production of free acidity, moisture, colour and rancidity with loss of oil.

It will be seen, later, that in the trial shipment of good baled copra, no oil loss whatsoever has occurred, and that the free acid formation is somewhat less than the average for sacked Malayan copra of good quality.

## Control Analyses of a Trial Shipment of Copra.

A small quantity of copra was taken from each bagful of a large consignment of copra, prior to baling. This total sample, weighing about 360 lbs., was then well mixed, spread evenly on the floor, and the pile divided into four quarters. The copra from two diagonally opposite quarters was taken for pressing into a sample control bale, to be kept in the store shed of the Department of Agriculture, and the copra of the remaining two quarters was then "quartered down" until only 10 lbs. was left. From this small amount, three samples were drawn for determination of the percentages of moisture and oil in the copra, and of the acidity of the cold expressed oil. The loose copra still remaining was then placed in a sack and stored under the same conditions as the control bale. The results of the analysis, and the appearance of the copra indicate that the copra was of normal good F.M.S. quality.

**Analysis prior to Despatch.**

| Test. | Sample No. 1. | Sample No. 2. | Sample No. 3. | Average. |
|---|---|---|---|---|
| Moisture *o/o* ... | 6.8 | 6.7 | 6.7 | 6.8 |
| Oil *o/o* (wet basis, copra as received) ... | 60.1 | 60.9 | 60.6 | 60.6 |
| Oil *o/o* (dry basis) ... | 64.6 | 65.3 | 65.0 | 65.0 |
| Acidity *o/o* (as lauric acid) | .65 | .74 | ... | .70 |

The main consignment of bales was despatched to Europe and two months later the control bale and sack of copra stored at the Department of Agriculture were reweighed and tested with the following results:—

**Analysis after Two Months.**

*Loss in weight*

| Pack. | Nett weight June 25th. | Nett weight August 27th. | % loss in weight. |
|---|---|---|---|
| Bale - | 229 | 224 | 2.2 |
| Sack - | 113 | 111½ | 1.3 |

*Acidity of the cold expressed oil* (as lauric acid)

| Sample taken from | Date | Acidity *o/o* | |
|---|---|---|---|
| Loose copra before baling - | June 27th | -- | .70 |
| Copra from centre of bale - | — | 1.72 | Av. 1.44 |
| Copra from outside of bale - | Aug. 25th | 1.16 | |
| Copra from sack - | Aug. 27th | | 1.43 |

There was little evidence in either case of mould growth, although in both cases the copra had been attacked by a variety of insects. The stored bale shewed no signs of oil exudation, nor were there any indications of the copra

becoming self-heated by deterioration in the absence of freely moving cooling air within the bale.

The main consignment of this copra, despatched to Europe in baled form, arrived at its destination in August, where it was analysed both by the consignees (C) and also by an independent arbitrator (A).

**Comparative Record of Analyses.**

Total Oil Content—before and after shipment.

| | Weight in cwts. | Oil o/o (wet basis) | Total Oil cwts. |
|---|---|---|---|
| Loose copra before baling ... | 1904¾ | 60.6 | 1152 |
| The same copra as received in baled form in Europe (C) ... | 1845¾ | 62.8 | 1158 |
| (A) ... | 1845¾ | 64.0 | 1180 |

Quality.

| Sample taken from :— | Moisture o/o | Oil o/o (dry basis) | Acidity. o/o |
|---|---|---|---|
| Loose copra before baling ... | 6.8 | 65.0 | .70 |
| Stored in Malaya—baled ... | — | — | 1.44 |
| sacked ... | — | — | 1.43 |
| Baled copra as delivered (C) ... | 4.5 | 65.8 | 1.51 |
| (A) ... | 4.6 | 67.2 | 1.48 |

% Loss in weight in two months.

| Circumstances. | Loss in weight o/o |
|---|---|
| During storage in Malaya—as a single bale ... | 2.1 |
| —as a single sack ... | 1.3 |
| During shipment to Europe in baled form ... | 3.0 |

From the above it will be seen that the copra does not lose oil during baling, or subsequently during shipment and storage. The slight differences in the calculated amount of total oil are within the limits of experimental error if consideration is allowed for possible differences of method, and for personal error.

The acidity of the oil was determined here on the cold expressed oil and not on the oil extracted by solvents, the latter giving slightly lower results. It would appear that in spite of the cooler conditions on the way to Europe, the stacked bales deteriorated slightly more than the solitary control bale kept at the Department of Agriculture, whilst the loss in weight was also greater, though, of course, the conditions of storage were very dissimilar.

## The deterioration of Straits F.M.S. copra during shipment in sacks to Europe.

Eighteen large samples of F.M.S. copra from various estates in Malaya gave the following results on analysis:—

| Moisture o/o | | | Oil o/o (Dry basis) | | | Acidity o/o | | |
|---|---|---|---|---|---|---|---|---|
| Av. | Max. | Min. | Av. | Max. | Min. | Av. | Max. | Min. |
| 6.9 | 9.1 | 4.7 | 65.9 | 69.0 | 62.2 | .18 | 1.00 | .03 |

Seventeen different bulk consignments of Straits F.M.S. Copra, received in Europe in sacks, yielded the following figures from the analyses of the consignees:—

| Moisture o/o | | | Oil % (Dry basis) | | | Acidity o/o | | |
|---|---|---|---|---|---|---|---|---|
| Av. | Max. | Min. | Av. | Max. | Min. | Av. | Max. | Min. |
| 4.7 | 5.5 | 3.9 | 65.0 | 67.0 | 63.6 | 2.25 | 5.06 | .35 |

It will be seen that the average acidity has increased from .18% to 2.25% for copra in sacks, whereas the trial shipment of baled copra only increased in acidity from .7% to 1.5%. The loss of moisture for copra in bales and in sacks is however identical.

## Conclusions.

1. There is no indication of loss of oil during or after baling when the copra is properly dried, is of genuine F.M.S. quality, and is packed cold.

2. There is no evidence that the copra deteriorates more when in the form of compressed blocks, than it does when stored in sacks, in fact there are indications to the contrary.

3. The system of chopping before baling will ensure a product of uniform and convenient size which will be easy to handle by the crushers, and will also prevent the accidental inclusion of dirt and foreign matter by the producer.

4. Baled copra is convenient for handling, stacking, and checking.

5. The trial shipment arrived in Europe "intact and in good order".

6. The effective space occupied by copra in baled form is one third less than when stacked in sacks.

In conclusion, the writers wish to record their thanks to Mr. F. W. Douglas for technical assistance in this inquiry; also to Mr. Gunn Lay Teik for carrying out the analytical work.

The dollars quoted in this article are Straits Settlements currency \$1 = 100 cents = 2s. 4d.

Also 1 picul = 100 katis = $133\frac{1}{3}$ lbs.

For explanation of the significance of oil % (wet basis) and oil % (dry basis) see *Malayan Agricultural Journal* Vol. XVII—September 1929, No. 9.

# INSECT PESTS OF PADI IN MALAYA.

BY

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Wherever padi is cultivated it is attacked in various ways by many kinds of insects, some of which are responsible for a heavy annual loss to cultivators. Others are occasional pests, individually unimportant, but, when appearing in great numbers, capable of causing serious damage.

In Malaya, seventy-four species of insects have been recorded on padi. This information is based on the list included in a bulletin published by this Department in 1926 (1) and on records compiled by the Entomological Division up to the present time.

The following notes thereon, together with details of the habits and descriptions of some of the more important pests which cultivators have to contend with, are now put forward for general information.

The Orders in which the more important padi insects occur are the Rhynchota or bugs and the Lepidoptera or butterflies and moths.

Four species of Rhynchota may do appreciable damage to the padi crop, and a fifth species—*Tetroda histeroides*—, a black insect, elliptical in shape, having the front part of the head bifurcate, and the sides of the anterior margin of the thorax produced forwards, has been recorded as a serious pest of padi in South India (2). It is about five-eighths of an inch in length.

Of the other four, *Scotinophara coarctata* (Mal. Kutu bĕruang, bĕna kura) is frequently a serious pest in Pahang and along the Perak River in dry years, but is capable of being controlled, provided adequate water is available for flooding the fields.

*S. coarctata* is similar in colour to *T. histeroides*, but is about half the size and has no parts of the head or thorax produced. In all stages, it attacks the plant low down.

The life history of this species has been dealt with (3).

*Leptocorisa acuta* (Mal. Pianggang, Kĕsing, Chĕnangau) an elongate greenish brown insect with long and slender antennae and legs, feeds on the ripening grains and causes them to turn white, when entirely sucked out, and blackish when partially sucked.

The body is five-eighths of an inch in length.

*Sogata pallescens* a very small "bug" about one sixteenth of an inch in length, dirty white in colour with the forewings not thickened in the basal half, has, on more than one occasion, caused damage in Province Wellesley and Krian. It is known among the Malays as bĕna or bĕna puteh, which also include *Sogata distincta.*

The areas attacked can be readily picked out in the field, for the plants are distinctly yellow, and as the insect appears never to miss a plant, the affected area is distinctly demarcated. The eggs are laid at the mid-rib of the leaf blade, and the part turns reddish brown afterwards. The female inserts her eggs under the cuticle by making a longitudinal slit which is oblique to the surface of the leaf.

The eggs are spindle shaped. Two days after oviposition the part of the leaf turns brown and three days after that the incubation is completed.

Leaves examined in the laboratory for eggs of *Sogata* revealed the presence of numerous mites, which may be instrumental in suppressing outbreaks. The mites appeared to be of two forms differing considerably in appearance, but it is believed they may be stages of the same species.

The first immature stages, more properly called the first stage nymphs of *Sogata* are greyish green just after hatching. After two days, however,, the nymph is light grey with dark grey patches on the thorax and abdomen. The legs are greyish and the under surface of the body pale cream colour.

They appear to feed mainly on the leaf blade, but a few have been observed to attack the leaf-sheath fairly low down on the plant. Some first stage nymphs are covered with white wax-like scales.

The favourite site of feeding of the adults appears to be just above water level, the insects attacking the leaf-sheath at this point, but both older nymphs and adults have been observed on leaf blades as well.

When the plants are disturbed, all stages of the insects jump off on to the water and make their way to neighbouring plants. The adults when submerged for a few minutes remain quiescent in most cases and appear to suffer no ill effects, nor are they wetted.

It has been found that an outbreak may be suppressed by draining off the water for about two days, when fresh water may be run on if required.

It is said that the water in badly attacked areas is malodorous, and it is this which led to the draining of the water, and to the subsequent discovery that the pest then disappeared. This practice has been carried out on several occasions in more than one place with similar results.

The Lepidoptera are represented by six identified species, of which three feed on the leaves and three bore inside the stem. The latter are the more important and frequently occasion considerable loss to the rice growers. Affected plants are conspicuous in the latter stages of attack, having the leaves, particularly the centre ones, brown and withered.

Stem borers are collectively known to the Malays as "ulat batang padi" and also "ulat kisar".

The three identified stem borers are *Diatraea auricilia, Schoenobius incertellus* and *Sesamia inferens.*

The eggs of the first named are laid in masses on the upper or under surface of the leaf blade. Between thirty and two hundred eggs have been counted in a mass. They are white at first, turning to yellowish grey, finally to black and are arranged irregularly and overlapping each other.

The caterpillar is whitish with irregular brownish interrupted stripes which run lengthwise. It makes no cocoon before it changes to a pupa.

The adult male is brownish yellow with some metallic spots on the forewings and with brownish white hindwings. The female is similar but larger. The metallic spots are smaller and the ground colour of the forewings is pale yellowish.

The male measures 18 mm. and the female 25—27 mm. across the forewings.

*S. incertellus* lays her eggs also in a mass on the leaf blade. The mass is covered with brownish scales. The caterpillars are somewhat variable in colour, ranging from almost white, through pale green to a dark dirty greenish grey. A cocoon of whitish silk is formed and this has a silken tube connecting it with the exit hole.

The adult male moth has brownish yellow forewings with a small central black spot; it measures 18—22 mm. The female has brownish forewings and pale smoky hindwings. The wing expanse is 34 mm.

The part of the padi plant chosen by the female of *Sesamia inferens* for depositing her eggs, is beneath the leaf-sheath, where she lays several rows in a mass.

The eggs are creamy-white when first laid, turning to flesh-pink on the second day. In shape they are hemispherical and are finely fluted on the sides.

The caterpillar is whitish with a pink tinge, and a chestnut brown head. A loose web of silk is formed, usually outside the stem, by the caterpillar.

The adult moth has pale bright fawn colour forewings with one or two suffused brownish stripes and whitish hindwings.

All these species can live as caterpillars in submerged stems, apparently being unaffected by the water in which they remain immersed. They frequently cause the early death of a plant by completely ringing the node at the point of entry before complete penetration of the stem occurs. Having done this it is not unusual for them to leave the stem and attack another.

A special campaign against the stem borers was instituted in 1929 following a severe outbreak in the Krian district.

Control of *Diatraea auricilia* and *Schoenobius incertellus* by means of parasites of the eggs was considered to be the only method likely to succeed, since the cultural methods of control which are advocated and are carried out in other rice growing countries would not, it was thought, be carried out with any measure of zeal or enthusiasm by the padi cultivators of Malaya.

It may be mentioned that the eggs of *Sesamia inferens* are practically immune from the attacks of parasites owing to their location on the padi plant.

In the present state of our knowledge, it is believed that *S. inferens* is not such an important pest of padi as the other two species of stem borers, but, should it prove to be so, other measures will have to be adopted for its control.

The caterpillars of *Nymphula depunctalis* eat a portion of the leaf and folding it, make a shelter in which they move about on the plant and on the

surface of the water. They are known as "ulat apong" and may do considerable damage in nursery beds. The caterpillar is light green with darker green longitudinal stripes and a light brown head spotted with dark brown.

The two army worms *Spodoptera mauritia* and *Spodoptera pecten* are leaf feeders, but being conspicuous they may be readily dealt with before the damage attains any magnitude.

The eggs of these two species are deposited in the leaves and are covered with scales from the abdomen of the female. The caterpillars are greenish-brown in colour with dark brown diagonal spots, and when full grown measure about 3 cm. in length. There is a certain similarity in appearance of the adults of *S. mauritia* and *S. pecten*, both having brownish forewings with whitish and dark brown irregular markings, and pearly white hindwings.

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# PINEAPPLE CANNING.

BY

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Factory methods for canning pineapples vary considerably between Malaya and the other countries of production, notably Hawaii. In the latter country, machinery is used as much as possible, whereas in Malaya, owing to its relative cheapness, hand labour is employed for almost all the operations. It is a curious fact that while in Hawaii the cans are purchased from a central canmaking factory, in Malaya, each factory is equipped with a complete canmaking machinery.

A further marked difference between these two countries is that in Malaya the factories are generally established in close proximity to the pineapple plantations. The most distant are the five factories in Singapore, which draw the bulk of their supplies of fruit from Johore—a matter of perhaps 30—50 miles by road. The nearest to the centres of production are in Johore where there are twelve factories, situated so close to the fields that transport is reduced to a minimum. The principal factories in Hawaii and Africa may be situated a considerable distance from the plantations. The nearest plantation to the largest Hawaiian factory is twenty-five miles distant. The Port Elizabeth factory is 125 miles from the estate, the latter being intersected by over 150 miles of roads.

The fact that by the Malayan method, transport both of fruit and empty cans is reduced to a minimum, has its advantages. The fruit can be harvested in a riper condition than would otherwise be possible, while the factory methods are such that generous use is made of labour—which is comparatively cheap; while freight—which is comparatively expensive, is reduced to a minimum.

The question of power must also be considered in connection with situation and size of factory. In Hawaii, electricity is used at a cost of from 2—4 cents (gold) per kilowat. In Malaya, the power required for a factory of 1,000—1,500 cases per day can be supplied by an engine of 15—20 h.p.

## Capacity of Factory.

Factories in Hawaii are capable of turning out 1,500 cases per day; one factory is said to have a capacity of 4,000 cases a day. The largest output by a factory at Port Elizabeth, South Africa, is stated to be 2,300 cases per day. From a consideration of the number of factories working, the methods employed, and the total quantity of canned pineapples exported, it is evident that the

average capacity of a Malayan factory is lower than that of Hawaii or Port Elizabeth. Probably from 1,000 to 1,500 cases per day is the utmost limit of our local factories, while the capacity of the majority is even less.

## Cost of Factory.

According to an Hawaiian authority, the cost of machinery, (excluding the cost of the buildings) capable of producing 1,500 cases per day, would be the equivalent of about $90,000 (Straits Currency). An important pineapple packer in Malaya published a statement in 1927 that "about $150,000 capital is necessary for an ordinary pineapple factory and for a factory of bigger capacity $300,000 will have to be invested". These figures, obviously, include working capital. The machinery in a Malayan factory with a capacity of 1,000 cases a day may be between $13,000 and $20,000 excluding shafting, power and cost of building.

The following details of factory methods refer to Hawaii and South Africa. The Malayan methods are so different, that they will be stated subsequently.

## Can Making.

Hawaiian canners do not manufacture their own cans, but purchase them at $28 (gold) per 1000 from a can-making factory. A similar system is employed in Formosa, where the areas under the crop are somewhat scattered.* The Port Elizabeth factory manufactures its own cans with a plant capable of producing 30,000 to 35,000 cans daily.

A machine cuts the tin-plate to the requisite size for the body of the can. Flanges are then cut at each end of the body section to make the hooks or edges which will interlock to form the two side seams. It is then rolled to a cylinderical shape, double seamed interlocked and automatically soldered. The bottoms and tops are cut out and shaped by a press, the bottom being then fixed on by a seaming machine. Rubber solution (in Malaya, a thin band of rubber, locally manufactured) is applied in a groove on the outer edge of each disc; this renders the use of solder unnecessary and ensures that the cans are airtight.

## Peeling, Coring and Sizing.

The "Ginaca" machine automatically performs the operations of peeling, coring and sizing. It is made in three sizes; viz., No. 2½, No. 2, No. 1. It has the disadvantage that it will only prepare fruit of one size diameter and cannot be adjusted to fruits of different sizes. The 2½ "Ginaca" will handle

* The pineapple canning industry in Formosa is relatively small, but is rapidly increasing.

about 38 pines per minute. It is made by the Hawaiian Pineapple Company and çosts $5,900 (Gold).

In the operation, the pines climb a chain conveyor and are placed in position. The machine then cuts off the skin in two pieces, cuts off the top and bottom, extracts the fruit still adhering to the skin, then cores the pine.

The fruit is then conveyed to a trimming table, where any irregularities are rectified by hand.

A slicer is then employed, also made by the Hawaiian Pineapple Company, costing $2,000 (Gold), which cuts the fruit into slices about half an inch thick.

## Canning.

The fruit is graded as it proceeds along a conveyor. The usual method is for certain of the workers to be responsible for picking out the best for "fancy" quality, others being responsible for standard quality—the remainder being broken pieces.

The broken pieces are conveyed to vats where they are broken up and boiled, becoming crushed or grated and packed in cans for special markets.

Cans containing slices are taken to a vacuum machine, costing $1,800 (gold), which removes most of the air, and thence to the Syruping Machine ($1,100 gold) which fills them with sugar syrup and thence to the Exhaust Box, a steam chamber, where they remain for six minutes at a temperature of 210°F.

The Double Seamer ($2,500 gold) places the lid in position, bends the edges down and under, after which a second machine flattens them hard in this position.

The cans are then sterilised for seven minutes at a temperature of about 222°F., and placed in a Lacquer Bath ($250) which improves the appearance of the can and is said also to retain the can in an airtight condition.

Subsequently the cans of fruit are dried and stored until labels are affixed.

## Syruping.

The syrup with which the cans are filled is prepared with cane sugar and water, pineapple juice not being employed in its preparation. O'Conner reporting on the South African product states:—

> "Different syrups are used according to the variety of grade of fruit canned. As the 'Giant' or 'Cayenne' pineapple is less sweet than the 'Queen' variety, more sugar is used in preparing the syrup in which it is preserved".

The following is the percentage of sugar used:

For Queen Pines, 1st Grade fruit 27% sugar
For Queen Pines, 2nd Grade fruit 16% sugar

For Cayenne 1st Grade fruit 40% sugar

For Cayenne 2nd Grade fruit 30% sugar

Under the Canadian regulations affecting the importation of canned pineapples, the following are laid down respecting syrup.

"Heavy Syrup" for pineapple will be considered as that syrup which cuts out not less than 23 per cent Balling at 60°F.

"Light Syrup" for pineapples will be considered as that syrup which cuts out not less than 17 per cent Balling at 60°F.

## Malayan Factory Methods.

The operation of peeling and cutting or slicing are always performed by hand. Grading is performed by the worker during these operations.

The following machinery is usually employed in a Malayan pineapple canning factory.

*Foot Shears,* for cutting the tin-plate into strips. Cost varies from $300 to $500 (Straits Currency). Two such machines are necessary in a factory having a capacity of 1000 cases per day. Each machine can be worked by one man.

*Roller Shears,* for cutting the body strips for 1½lb. flat size. The machine will cut six strips at a time. One such machine required: cost about $1,000.

A locally made hand machine, costing about $25 each is employed for rolling the body pieces. From five to ten machines of this description are used in a factory.

The edges of the body pieces are then notched by hand with a pair of scissors.

*Soldering.* Lap-soldering of the body pieces in cylindrical form is performed by hand. The usual contract price for this work is 11 cents per 48 cans.

*Automatic Boardering Machine,* prepares top and bottom edges for double seaming. Two such machines, costing about $500 each, each with a capacity of 3000—4000 cans per hour are used. Each machine can be worked by one man.

*Punching Press,* for cutting tops and bottoms: three or four such machines employed at a cost of about $900 each. The dyes of different sizes for these presses are locally made and cost from $100—$200 each according to size.

*Double Seamers.* For seaming bottoms to body. Cost $700 each. Two machines of this description are used for the bottoms, and another two for the lids. Capacity, about 1500 per hour for each machine.

## Grades.

Malayan pineapples are packed in three grades viz. Special Golden, Good Average Quality (G.A.Q.) and Number 3. No. 2, now less frequently pre-

pared, finds a market in China. The popular description is cube, although slices and whole pines are prepared for special markets. Several descriptions of shapes of tin and weights of content are marketed, although the tendency recently has been to reduce the number. A case of pineapples may contain 48 cans of 1½ lb. each, a case of 2 lb. cans may contain 24 or 36 cans according to whether the packing is of whole pines or slices, while the packing of 2½ lb. cans invariably has 24 cans to a case.

In Hawaii, the 'sliced' is packed in two grades, 'fancy' and 'Standard' and apart from 'Crushed and Grated' and one or two Special packings, only round cut sliced is made.

## By-Products.

Only about one-third by weight of the pineapples received in the factory is utilised. In Malaya, no use is made of the waste from the factory. Greenstreet and Gunn Lay Teik* shew that for the economic disposal of the waste, the removal of the juice is essential. They describe remunerative methods of disposal of the partially dried waste, and also shew that the fermentation and distillation of the fresh juice for the production of a potable alcoholic liquor similar to brandy is a simple process. As far as the present writer is aware, no factory in Malaya has commercialised these results.

## Cost of Canning.

It is stated that canned pineapples can be produced in Hawaii at £20 per ton delivered to the consumer, the factory cost being about $1.50 (gold) per dozen cans.

The African costs are said to be £5 per ton for fruit, and £5 per ton for cost of manufacture.

In 1927, a Malayan pineapple packer published the following statement of the factory costs per case of 72 lbs.

| | | |
|---|---|---|
| 16 sheets of tin plate | ... | $1.65 |
| Lead and soldering | .. | 0.10 |
| Good White Sugar | ... | 0.80 |
| One empty wooden case | ... | 0.50 |
| Labour | ... | 0.40 |
| Water and fire wood | ... | 0.20 |
| Rubber stripping | ... | 0.10 |
| General expense of the factory | ... | 0.75 |

a total of $4.50 per case of 72 lbs. to which must be added the cost of the pines (80 medium quality pines per case, costing from 1—2 cents each). The total cost per ton on this computation would be $186/- or approximately £22

* "Bye Products of the Pineapple Canning Industry" by V. R. Greenstreet and Gunn Lay Teik. *Malayan Agricultural Journal.* Vol. XVI. No. 1. January 1928.

per ton. In view of the fact that the price of canned pineapples in Singapore is below this figure, it must be supposed that packers have been able to reduce their costs of production. In any case, the above statements of costs in different countries must be taken, at best, as only a rough approximation.

In conclusion, the writer has tried to shew that the Malayan pineapple canner has endeavoured to establish a market for a cheap but good quality product. This has been made possible by the following means; employing cheap labour, treating pineapples as a catch crop, placing the factories near centres of production, and producing a less elaborate and unlacquered can. The market now established, the quality of the product has been improved, and there would appear scope for further extension of the industry.

In the preparation of the above article, the writer is indebted for considerable assistance from the following sources: Notes on the Pineapple Industry in Hawaii, from a private source; The Pineapple Industry in South Africa from a Report by Mr. C. A. O'Conner of the Mauritius Department of Agriculture; Mr. P. T. B. Hansen of Singapore; The Empire Marketing Board Reports; and data collected from time to time by various officers of the Department of Agriculture, S.S. & F.M.S.

# PEAT AS A FERTILISER.

BY

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*Assistant Mycologist.*

In view of the interest recently aroused as the result of proposals for the economic utilisation of local peat deposits by the conversion of the peat into a fertilising material by means of a microbiological process, the following summary of past investigations bearing on this subject has been compiled.

Two methods of treatment have been suggested.

1. A treatment designed to render the peat available as a nitrogenous fertiliser.
2. A treatment designed to render the peat available as a carbon dioxide fertiliser.

## PEAT AS A NITROGENOUS FERTILISER.

In 1912, Bottomley (1) announced that when peat was treated with certain aerobic soil organisms, the insoluble humic acid, which was present in this material in large quantities, was converted into soluble ammonium humate, a substance capable of supplying the nitrogen needs of plants, providing soluble phosphates and potassium salts were present. Further he reported (2) that this 'bacterised' peat after being sterilised formed an excellent medium in which to grow and distribute non-symbiotic nitrogen-fixing bacteria, and that an aqueous extract of bacterised peat supplied all the plant food necessary for water cultures with tomatoes, barley, etc. Experiments conducted on various pot plants produced evidence that bacterised peat possessed growth stimulating properties not to be accounted for by any known mineral constituents present. The stimulating substances were soluble in water, and effective in very minute quantities, and it was suggested that they were similar in function to the accessory food bodies (vitamines) concerned in animal nutrition. A long series of experiments were carried out with *Lemna* and other aquatic plants from which it was deduced that these stimulating substances or 'auximones' were essential for normal plant growth (3,4). Clark and Roller (5) who repeated Bottomley's experiments some years later came to the conclusion however that the normal growth of *Lemna* in mineral solutions was dependent merely on a suitable concentration of salts, and that auximones were not essential, but it was possible that they functioned as accelerators.

Bottomley secured several patents for the manufacture of bacterised peat, or 'Humogen' as it came to be called, and various field and pot trials were under-

taken. When used as a fertiliser on moorland soils the yield of oats and mangolds were said to have been doubled (6). At Woburn, in the first season's trials, bacterised peat was compared with heated fen soil, a substance which had previously been used with good effect. In the case of mustard and barley, treatment with bacterised peat resulted in a definite increase in yield (7). In the following season the value of the nitrogen in the treated peat was compared with that in sodium nitrate. With oats the yield of grain was about the same, but bacterised peat produced a marked increase in the yield of straw. With mustard, treatment with peat gave a clear advantage. Nevertheless it was held that 'the value of bacterised peat for farm crops has yet to be established' (8). Field trials carried out at the Midland Agricultural and Dairy College with wheat, 'seeds' hay and potatoes were entirely negative (9).

In response to a request made by the Board of Agriculture trials were conducted in 1916 at Rothamsted, the results of which have been summed up in a report by Russell (10). There was no evidence that Humogen possessed any special agricultural value or that it was any better than any other organic manure with the same content of nitrogen. Bottomley claimed that the failure of these Rothamsted experiments was due to the use of lots of Humogen which had been wrongly prepared, and as the result contained an excess of sodium carbonate.

In 1916 Makrinoff (11), at that time ignorant of Bottomley's work, began in Russia a series of field experiments designed to determine whether it was possible to improve soil fertility by the introduction of micro-organisms. It was recognised that in some soils the non-symbiotic nitrogen fixing bacteria (*Azotobacter* and *Clostridium*) are insufficiently provided with the carbonaceous matter which is essential as a source of energy. Pringsheim (12) and Koch (13) had arrived at the conclusion that the calcium salts of the various organic acids, formed as the result of the decomposition of cellulose by aerobic cellulose bacteria, were a suitable source of carbon for nitrogen-fixing bacteria. With this in mind Makrinoff assumed that the addition of cellulose bacteria and *Azotobacter* to peat soils fertilised with mineral manures would exert a favourable influence on their fertility, and in order to test this hypothesis, four plots were laid out on virgin peat soil which received the following treatment:

(1) Control; (2) Minerals only; (3) Minerals + *Azotobacter*; (4) Minerals + *Azotobacter* + aerobic cellulose bacteria.

The plots were sown with oats and the following crops harvested:

(1) No crop; (2) 16 pounds; (3) 41 pounds; (4) 57 pounds.

## Conclusions.

In spite of the unfavourable verdict which followed the Rothamsted trials of Humogen, the remarkable results obtained by Bottomley in his earlier experiments both with water cultures and with pot plants at Kew and at Chelsea, the undoubted stimulation of the growth of *Lemna* by the addition of minimal

quantities of bacterised peat extract, and the favourable results of the Woburn trials would alone show that his work cannot be summarily dismissed, but when also Makrinoff's experiments are taken into consideration it seems evident that the whole question is worthy of further investigation.

Whether either Bottomley's theory, that the aerobic cellulose bacteria convert 'insoluble humic acid' into 'soluble humates', or the conclusion of Pringsheim and Koch, that the decomposition induced by these organisms results in the production of organic acids, whose calcium salts form an energy source for nitrogen-fixing bacteria, is correct, does not affect the fact that both Bottomley and Makrinoff appear to have shown that when raw peat is acted upon by certain aerobic organisms and then inoculated with *Azotobacter* it becomes converted into a medium which is able to stimulate and support the growth of crop plants.

Finally some support for their claims is to be found in the recent work of Itano (14) who as the result of a biological investigation of peat is of the opinion that there is a possibility of rendering this material available as a nitrogenous fertiliser when its H-ion concentration has been corrected, and certain accessory substances have been added to stimulate the growth of the micro-organisms already present.

## PEAT AS A CARBON DIOXIDE FERTILISER.

The consideration of this aspect of the subject is concerned not only with the question whether peat can be converted into an efficient carbon dioxide fertiliser, but also whether carbon dioxide fertilisation is of any practical value.

### Carbon Dioxide Fertilisation.

The practice of carbon dioxide fertilisation is based on the theory that the carbon dioxide content of the atmosphere surrounding crop plants is not at an optimum for their growth and that their development can therefore be stimulated by increasing the supply of this gas.

The experimental evidence bearing on this subject can be reviewed under two headings.

1. Experiments with closed atmospheres (glasshouse trials).
2. Experiments with free atmospheres (field trials).

**1. Experiments with closed atmospheres.**—Timmis (15) working at the Cheshunt Experiment Station found that when a closed glasshouse was exposed to bright sunlight for three hours the carbon dioxide concentration of its atmosphere was reduced. Owen and Williams (16) working at the same station stated that the yields of tomatoes were increased as much as 25% by the evolution of a continuous supply of carbon dioxide from the soil surface and further (17) that treatment with 0.6% carbon dioxide for one hour daily resulted in a distinct benefit to the crop. Preliminary work at the Ohio Experiment Station

(18) is said to have shown that a 26% increase in the yield of lettuce could be obtained by the addition of small amounts of carbon dioxide. In continuation of the Cheshunt experiments, Owen and Small (19) demonstrated that yields of cucumbers were also markedly benefited by treatment with carbon dioxide.

These results have been confirmed in Germany by Muth and Voigt (20), Lobner (21), Kochs and Hosterman (22) and the Rhine Province Horticultural Station (23).

A critical study of carbon dioxide fertilisation in closed atmospheres is now being undertaken at the Imperial College where Blackman (24) has already shown that with a given light intensity the growth of cucumbers can be increased 85% in eleven days by raising the carbon dioxide concentration.

**2. Experiments with free atmospheres.**—The evidence on this aspect of the subject is so contradictory that, for the sake of clearness, it is best grouped as 'negative' and 'positive'.

**Negative evidence.**—Spirgatis (25) maintained that an increase in the carbon dioxide content of the air can only give an increase in yield if the light factor is depressed, and that the carbon dioxide present in the atmosphere is sufficient under normal conditions for the production of maximum crops. Lemmerman and Kaim (26) found that there was no evidence that the carbon dioxide content of the air over soils lightly fertilised with farmyard manure is greater than the average carbon dioxide content of the atmosphere. Densch and Hunnius (27) studied the effect on field crops of increasing the supply of carbon dioxide and failed to observe any increase in yields. Appleman (28) increased the carbon dioxide content of the soil air by the incorporation of organic matter and observed that the development of potatoes growing in this higher concentration was retarded, but increased and equalled that of the control when the carbon dioxide concentration was reduced by cultivation. Lemmerman (29) has recently shown that although large amounts of carbon dioxide are liberated from the soil when organic manures are applied, this increased supply is not very important for the carbon nutrition of plants owing to air movements which rapidly remove it.

**Positive evidence.**—Lundegardh (30) came to the conclusion that it was possible by fertilisation to produce an atmosphere surrounding crop leaves enriched in carbon dioxide, and that (31) the carbon dioxide of the soil atmosphere was a more important source of carbon for the growth of plants than the carbon dioxide of the air. Muth and Voigt (20) stated that the yield of cabbages could be stimulated by applications of carbon dioxide in the open air. More recently Lundegardh (32) has announced that the general indication of numerous experiments is that a carbon dioxide supply up to or approaching the limit of tolerance markedly increases the yield of total dry matter in a crop. A particular striking experiment consisted in placing impervious troughs in furrows between rows of beets and filling the troughs with farmyard manure. Although no part of the manure save the evolved gas reached the plants an increase in yield was produced. Reinan (33), who is the author of a book on this subject, is of the

opinion that carbon dioxide fertilisation can be practically and economically applied in the growing of almost any crop.

## Conclusions.

That carbon dioxide fertilisation is of value in the cultivation of glasshouse crops seems to have been clearly established. On the other hand the evidence in regard to field crops is extraordinarily inconsistent. Lundegardh's trough experiment is significant, but it needs confirmation. Nevertheless that under some conditions of light intensity, the carbon dioxide content of the atmosphere (at least in temperate climates) is a limiting factor for the growth of certain crops is evident from Blackman's statement (34) that a cereal or clover crop employs in the manufacture of plant material only 1 to 3% of the energy of the sun which reaches the ground, this low efficiency being largely due to the low concentration of carbon dioxide available for the process of food manufacture; and furthermore that with high concentrations of carbon dioxide and weak light the plant may work with an efficiency of nearly 60%.

## Peat as a Carbon Dioxide Fertiliser.

According to statements made in the local press (36) a microbiological process has been devised by means of which peat, among other substances, can be rendered available as a carbon dioxide fertiliser, and it is claimed that considerable increases in crop yields can be obtained when this treated peat or 'Biochemica' is applied to the soil.

However only one reference to trials of peat as a source of carbon dioxide can be found. Gerlach and Seidel (35) carried out tests of an alleged carbon dioxide fertiliser containing 30% of peat, 15% of carbonaceous material and 5% of so-called catalytic material. No increase in crop yields were obtained and in some cases yields were diminished.

## Conclusions.

There is no reason to believe from the available evidence that peat or treated peat has yet been proved to be an efficient carbon dioxide fertiliser.

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# THE UTILISATION OF SISAL WASTE FOR PRODUCTION OF ALCOHOL.

BY

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Interest in the utilisation of sisal waste has been aroused by patenting* of a process for the extraction and alcoholic fermentation of sisal juice and by an investigation on similar lines carried out in Kenya.†

Since sisal has been shown to be suited to Malaya, an investigation of the potentiality of its waste for the production of alcohol was carried out on leaves from plants growing at Serdang Experimental Plantation.

Fresh leaf from four year old plants was found to contain 3% sugars of which 2·6% was reducing sugars: the juice extracted from the leaf contained 3·5% sugars of which 3% was reducing sugars.

**Composition of Fresh Sisal Leaf.**

| | |
|---|---|
| Total sugars | 3·0 per cent. |
| Recoverable fibre | 3·6 ,, |
| Moisture | 85·0 ,, |
| Waste cellulose (by difference) | 8·4 ,, |
| | 100·0 per cent. |

The sugar content of the juice of sisal leaf in Kenya was found to increase from 1·0 per cent up to a maximum of 4·9 per cent at the age of four years and then decrease again. Figures for the sugar content of sisal leaf in Kenya are not given.

The economics of the process were investigated in Kenya and the conclusion arrived at was that only with a juice containing as much as 8·5 per cent sugar could the process be worked economically: with the sugar content the final cost of the alcohol per gallon was estimated at 4d. The cost in the case of juice containing 3 and 4 per cent of sugar was estimated at 1/- and -/9d. respectively. The possibility of fermenting the cellulose fraction of the waste was also considered in Kenya but found to be too expensive for economical exploitation: this residue would be useful only as fuel.

The conclusion derived from this investigation is similar to that arrived at Kenya, namely that on account of the low sugar content of the juice, profitable exploitation of the waste for the production of power of alcohol is not possible.

* British Specification No. 301, 284. 1928.

† Colony and Protectorate of Kenya, Bulletin No. 6 of 1929.

# ABSTRACTS.

## SECONDARY LEAF-FALL OF RUBBER.*

This disease is caused by a mildew fungus known as *Oidium Heveae* Steinm. which attacks the flowering spikes of the rubber tree and the young leaves as they develop after the 'wintering' period.

During the course of a visit to the southern part of the Negri Sembilan, the Territory of Malacca and the north of Johore, the disease was found to be present on seventeen estates and in most small holdings along the road side; in fact a heavy infection was observed in all rubber areas along the route taken. Observations made on this occasion together with supplementary records showed that the area of infection included the whole of Selangor, Negri Sembilan, Malacca Territory and North Johore.

Infection of the inflorescences was complete in all districts, but the leaf infection was most severe in Malacca and southern Negri Sembilan and decreased with the increase in distance from these areas.

It was observed that very few inflorescences remained on the tree and that very few flowers opened to maturity. Early wintering trees had, almost without exception, failed to set fruit and late wintering trees, though bearing a heavy flush of flowers, were all so heavily infected with the fungus that few if any flowers would ever reach maturity.

The mildew fungus usually attacks only young leaves from ½ to 2 inches long, though investigators in Ceylon and the Dutch East Indies report that older leaves may also be attacked. Many of the young leaves die and fall from the trees, so that the presence of a number of these young leaves on the ground serves as an indication of the presence of the disease.

Leaves may apparently recover from an attack, but remain for a long time in a weak pendant condition, eventually extending to give malformed, wrinkled, pale or mottled leaves, many of which are so weak as to be forced off the tree by subsequent rain or wind.

The causative fungus can be easily demonstrated, particularly with the aid of a hand lens, on the flowers and flower stalks, on the latter of which its presence is characterised by a glistening powdery appearance. On the leaves

* Abstracted from a "Report on a Visit to the Malacca Territory and Southern Negri Sembilan to Investigate the Occurrence of *Oidium Heveae*", by F. Beeley, Field Officer of the Rubber Research Institute of Malaya. A copy of this report was kindly supplied by the Acting Director of the Institute with permission to abstract it in advance. The full report will appear in the next number of the Quarterly Journal of the Institute.

the fungus is often very difficult to see, though when the leaf surface is viewed in certain angles of light, a vigorous growth of the fungus may become visible to the naked eye as a slight, glistening, furry surface distinguishable from the otherwise smooth leaf surface.

A few trees were observed to have their second flush of young leaves heavily infected. Such foliage was light, weak and pale yellow green in colour.

The extent of actual leaf fall appeared to be in proportion to the weight of foliage normally produced by the trees. Trees in good soil bearing thick foliage suffered a heavier fall of leaf than those in poorer soil bearing thinner foliage, but the former class of trees made a far more rapid recovery. The flowers in all cases were almost completely destroyed.

The disease was observed on trees of all ages over 2½ years. Partial wintering of young trees of 2 to 4 years old caused the attack in such clearings to appear only on a few branches of which the leaves were sufficiently immature to be susceptible.

No special type of tree appeared to be affected to a greater extent than any other type. The taller trees appeared to suffer more than those of normal height within the same area. Closely planted small holdings of rubber appeared to have shed more leaves than more widely planted estate trees, as evidenced by the amount of green leaf on the ground; but the apparently larger quantity of such fallen leaf in small holdings may have been due to the more humid conditions resulting from close planting, since these conditions would tend to cause a slower discolouration and decomposition of the young fallen leaves.

No immune trees were observed.

Soil types, covercrops and period of resting from tapping did not appear to have any influence on the incidence or severity of the attack, neither did the application of manures appear to have much effect. Only in a few cases where applications of nitrogenous manure had delayed wintering sufficiently to make the arrival of the young leaves coincident with the arrival of wet weather had the the developing foliage excaped the disease to some extent.

The amount of rainfall seems to have an all-important influence on the severity of attack, especially on the leaves, since in the two years 1928 and 1930, when the first quarter of the year was abnormally dry, the disease was much in evidence, while in the corresponding period of 1929 when normally wet weather was experienced very few cases of mildew were recorded.

The association of mites with Oidium Leaf-fall was not borne out by these investigations. Mites were only present in advanced stages of the disease, when the mildew fungus was difficult to find and decomposition had commenced.

Owing to the very widespread infection the method of spread could not be determined. In all probability infection is caused by wind borne spores. No clue as to the type and location of a resting spore was found.

The possible effect of the disease upon the yield of rubber per acre was an important part of the investigation.

The results of this part of the work were, however, extremely disappointing. The effect of the disease itself was masked by the influence of a number of other factors affecting yields, such as the drought, changes in the position of the tapping cut, introduction of soil conservation schemes, changes in the nationality of tappers and periodic resting of trees, which had been in operation during recent years on the estates visited. It is however, important to establish the extent to which the disease affects yield, in order to ascertain if control measures can profitably be put into operation.

Fortunately experience so far shows that climatic conditions in Malaya are unsuited to a prolonged activity of the fungus and, therefore, extensive losses due to mildew attack are not to be expected. The chief effect will be felt in the seed harvest on account of the destruction of the flowers. Lack of seed for future planting programmes is therefore more likely to cause anxiety than is the possibility of an appreciable reduction in yield.

## SECONDARY LEAF-FALL OF RUBBER—A NOTIFIABLE DISEASE.

The attention of owners and managers of land planted with rubber is invited to notification No. 859 in the Straits Settlements Government Gazette of May 2nd, 1930 and to notification No. 3129 in the Federated Malay States Government Gazette of May 9th 1930. The effect of these notifications is to add Secondary Leaf-fall of rubber trees caused by the fungus *Oidium Heveae* Steinm. to the Schedule of diseases and pests the presence of which on estates and small holdings in the Straits Settlements and Federated Malay States is notifiable under the "Pests Notification Rules" of 1925 and 1927. Similar action is under consideration in Johore. In consequence of these notifications the presence of secondary leaf-fall on any rubber trees must be reported within two weeks of finding it to the Director of Agriculture or the Agricultural Field Officer in the area in which the disease is discovered, in the case of the Straits Settlements and Federated Malay States, and to the Principal Agricultural Officer, Johore, if similar action is required in that State. This action has been taken in order that the Department of Agriculture may be fully informed of the present extent and future spread of the infection and be in a position to take action to control the disease, should this prove necessary.

# REVIEW.

## THE BRAZIL NUT IN MALAYA.

BY

J. Lambourne.

*Special Bulletin. General Series No. 2. Department of Agriculture, S.S. & F.M.S. 14 pp. 6 pls. Kuala Lumpur. March 1930. Price fifty cents.*

This publication gives a botanical and historical survey of the Brazil nut tree in Malaya. It is shewn that the plant was introduced to Singapore in 1881, and was planted in Kuala Lumpur in 1912, commencing to fruit some ten years later. Observations on the variability of the trees and also of the nuts produced is given in some detail.

The method of cultivation of the tree is described and a statement given of the yields obtained from the Kuala Lumpur trees for the past five years. Favourable reports on samples submitted to London importers are reproduced and also notes on the handling of the crop in Brazil.

The Author concludes that the Brazil nut tree is unlikely to be of commercial importance in Malaya on account of the length of time it takes to reach the bearing stage and the relatively small crops obtained at least in the early years of fruiting. On the other hand, it is very desirable that it should be planted on a small scale around private dwellings for home consumption.

We would go further in suggesting that the tree is suitable for cultivation in native holdings, where it would form a useful addition to the fruits grown and might prove of profit to the owners in years to come, as the fruit would find a ready local sale.

D.H.G.

## FROM THE DISTRICTS.

### The Weather.

In general there was a good normal rainfall during the first half of the month, followed by dry weather modified as in Southern Perak and Selangor by occasional showers, or as in Western Pahang by a few days of wet weather at the close of the month. In Perak North and Malacca the month was on the whole dry with showers at the beginning of the month and in Malacca further showers towards its end.

*Rubber.*—The great majority of large estates have observed the May tapping holiday and have utilised their labour forces for work on general maintenance including measures for soil conservation. On the other hand most of the owners of small holdings have continued to tap their trees as usual, either because they could not afford to stop, or because they hoped to benefit from the rise in price which they expected would result from cessation of tapping on large estates.

Early in the month secondary leaf fall disease caused by *Oidium Heveae* was definitely found to be present on a few small holdings in Batang Padang District of Perak. Its presence was suspected in a number of areas in the same District and in Lower Perak, but by the end of the month the majority of the holdings had recovered, as had many infected estates and holdings in Selangor, Negri Sembilan and Malacca.

*Padi.*—The Krian padi crop is estimated to have been 10,845,380 gantangs. This is well below an average crop and is mainly accounted for by the complete failure of the very late planted padi in the mukims of Briah, Gunong Semanggol and Selinsing. Preparation of the land for next season's crop was commenced in most padi areas, the principal exceptions being those in Perak North. Wetter weather enabled transplanting from the nurseries to be effected in those mukims of Kuala Lipis and Temerloh districts which adjoin the Pahang river.

*Oil Palm.*—As a result of advice given on rat control an estate in Perak is not sowing a cover crop in its 1930 clearing. The use of sodium arsenite is proving effective in controlling rats in its older areas.

One estate in Johore is experiencing considerable trouble from white ants; their attacks frequently seem to follow weakening of the trees by crown disease which is present on about 20 per cent of the palms throughout the estate. A certain number of trees have also been attacked by root diseases of which the causative fungi are not yet definitely ascertained.

*Tuba.*—A beetle pest, probably *Nisotra* sp., occurs on tuba plants on three estates in Johore. On one of these a contact spray is stated to have proved very effective as a means of control at a reasonable cost per acre. Larvae and

pupae believed to be those of this pest have now been found in considerable numbers about three inches below the surface of the soil amongst the roots of the tuba.

*Coffee.*—A revision of the area planted with coffee in Malacca showed that it amounted to 428 acres, of which about half are interplanted with other crops. Most of the larger holdings are fairly well kept, except that pruning off suckers and side shoots and destruction of black berries and dead wood require more attention. The Agricultural Field Officer, Selangor, visited an estate in Kuala Langat district to arrange with the Manager a simple experiment on manuring coffee.

*Tea.*—The Agricultural Field Officer, Perak South, reports that stumps and basket plants are now exhibiting good growth in the area planted with tea to which reference was made on page 114 of the February number of this Journal. He adds that seedlings require constant supplying. He further remarks that the cover crop *Indigofera endecaphylla* is regenerating rapidly and that Albizzia stumps have been planted out and are growing well. *Indigofera endecaphylla* is also being used as a cover crop on a tea estate at a high elevation. *Grivillea robusta* has been planted on this estate as a shade tree and wind break.

*Sisal Hemp.*—Enquiries have been made for a suitable area of about 11,000 acres of land in Johore for the cultivation of this crop.

*Fruit.*—Durians have been fruiting in Penang, but the crop being harvested is small. The wholesale price at 15 to 20 cents each is high owing to the scarcity of fruit and the long distance which they have to be transported. A few mangosteens are on the market, but the fruit season is expected to be poor. In Malacca the main fruit crop is also expected to be below the average as the amount of young fruit on the trees is rather small.

*Pineapples.*—A large increase in the pineapple crop has occurred in Singapore during the month but it is expected that the maximum yield will be reached in June. Prices are poor for both the canned and fresh fruits. Pineapples have sold for 70 cents to $1.80 per hundred. Tinned pines vary between $3.25 and $3.75 per case, while the large tins are selling at $3.10 per case.

## Notes on Demonstration Stations and Padi Test Plots.

*Kuala Kangsar Demonstration Station.*—Sales of produce from this station included 16,000 small oranges at 50 cents a hundred, 65 ducks eggs at 3 cents each and 45 hens eggs at 5 cents each. The vegetable area at this station is being planted up with local and imported seeds.

Records now show that the eggs of the pure-bred fowls at Kuala Kangsar will not hatch satisfactorily if they are kept for more than three days before being placed in the incubator. Since all attempts to hatch duck eggs in an incubator have failed, local broody fowls are being obtained for this purpose. Care is being taken to keep the local fowls isolated from the rest of the poultry owing to the danger of introducing disease.

*Kuala Lipis Demonstration Station.*—Two plots of soya bean, varieties E.B. 3 and 4, were planted during the month and have germinated well. Two varieties of maize and plots of groundnuts have made good growth. Planting material of sorghum, ginger, and the greater and lesser yam has been applied for from the Government Experimental Plantation, Serdang. All available suckers of bananas are being kept for sale, the supply being unequal to the demand.

*Pringgit Fruit Station, Malacca.*—Suckers of Sarawak pineapple and seedlings of Liberian and Robusta coffee, together with five seedlings of cashew nut were planted.

*Pulau Gadong Padi Experiment Station.*—In preparation for the coming season's crop, the drains and water courses received attention and further precautions were taken to prevent flooding. Preliminary ploughing of all plots was completed and the preparation of nurseries was in progress. Preparation of an area for a new series of manurial experiments was commenced.

*Padi Test Plot.—Bukit Merah.*—An area of 10 acres of Crown land in Province Wellesley recently reserved for this purpose is being prepared for planting as a padi test plot in the coming season.

*Padi Test Plot, Glugor.*—Arrangements are being made to lease 5 acres of land in Penang and it is intended to commence work on this site early in June.

*Kuang Padi Test Plot.*—An area of 3 acres has been leased at Kuang in Selangor and the preparation of the land is in progress. Strains to be tested are Seraup Kechil 36 and 48, Radin 2, 4 and 13 and Nachin Puteh 27. Seed of the Seraups has been planted in the nursery.

*Kajang Paya Padi Test Plot.*—The strains to be tested this year are Seraup Besar 15, and Radin 2, 4 and 13. The Seraup has been planted in the nursery. Owing to a breach in the dam the supply of water has been insufficient to enable much progress to be made with the preparation of the land.

*Dong Padi Test Plot.*—Nurseries of the following eleven strains to be tested this year were sown on May 14th and 15th i.e. Seraup Besar 15, Seraup Kechil 52, 48 and 36, Radin 13, 7, 4, 3, and 2, Padi Pahit No. 1 and the local padi Jambak Bawang. The short period dwarf strain Serendah 875 will be sown in June.

*Temerloh Padi Test Station.*—The land was dug over with "changkols," a method of preparation which is somewhat unusual in this district where preparation is usually done by means of the hands only. Nurseries of Radins 13, and 7 made good growth. The strain Serendah 875 will be planted in June.

## Plant Distributions.

One thousand gantangs of pure strain padi Radin 2 were obtained from growers at Talang, Kuala Kangsar and sent to the Economic Botanist for distribution.

In Pahang 600 gantangs of hill padi seed were collected from the mukims of Talang and Sega and despatched to Temerloh District for planting. There is a demand for a further supply of 800 gantangs of seed if this can be obtained.

Small quantities of seed of the pure strains Nachin 10, 22, and 48 and Siam 29 and 77 from the Experiment Station at Pulau Gadong have been sent for trial in Krian and in Kedah and a supply of about 100 gantangs has also been sent to Chabau in Malacca for seed purposes.

In Province Wellesley vegetable seeds were distributed to school gardens.

## School Gardens.

In Province Wellesley the first half yearly inspection of all the 20 Gardens was carried out for the purpose of awarding marks for the annual competition. Some good work has been done though the gardens have only been planted a few weeks.

In Perak satisfactory progress has been made in the majority of school gardens inspected. The Agricultural Field Officer, Perak South and certain of his Malay officers have given demonstrations on cultivation and planting during gardening hours.

Elsewhere replanting gardens is progressing fast and work in general has been satisfactory.

## Shows.

It has now been decided to hold the Perak North Agricultural Show at Taiping on August 23rd and 24th. The dates fixed for the Seremban Show are July 25th and 26th for the Malacca Show July 25th and for the Kuantan Show August 26th. A show has also been arranged at Alor Star, Kedah, on July 10th and 11th.

## Rats.

In Province Wellesley rewards were paid for 137,345 rats tails during the month, making a total for the first five months of the year of 446,706. Poison balls distributed amounted to 12,370.

In Krian 118,696 rats tails were collected and 12,900 poison balls were issued.

In Malacca attention was paid to clearing away bushes and high grass adjoining rice lands in order to deprive rats of cover.

# DEPARTMENTAL NOTES.

## Honour for Dr. H. W. Jack.

His Majesty the King has been graciously pleased to confer the honour of Membership of the Most Excellent Order of the British Empire (Civil Division) on Henry Walter Jack.

Dr. H. W. Jack, B.A., D.Sc, joined the Department of Agriculture, S.S. & F.M.S., sixteen years ago. As a field officer, as an agricultural instructor and for the past eleven years as Economic Botanist Dr. Jack has devoted much of his energies to the improvement of the varieties of rice grown in Malaya. His researches into the subject have resulted in the establishment of strains of padi capable of yielding increased crops up to 30% of the normal.

The technique required for the accomplishment of this work and the detailed work in connection with the researches have been published in the *Malayan Agricultural Journal* and in Special Bulletins of this Department.

## Demonstrations to Chinese Agriculturists at the Experimental Plantation, Serdang.

On May 7th, sixty-two Chinese agriculturists, mainly from the Sungei Balak Settlement, attended a demonstration on tea cultivation and manufacture at Serdang.

The party was conducted around the plantation by Mr. Kanagaratnam, farm assistant, who explained in detail the various processes which were seen in operation, the interpretation being done by Mr. Lau Sing Nam, Chinese Sub-Inspector of Agriculture.

Although the party exhibited a sense of disappointment when confronted by the mechanical roller and roll breaker, maintaining that the employment of machinery was beyond their means, they were reassured however on learning that the principles demonstrated could be efficiently achieved without machinery, and that no further mechanical means were employed in the various processes of manufacture.

On the manufacturing side, the method employed at Serdang for withering attracted attention. This method of withering appeared to be entirely new to them, and the simplicity of the process, together with the cheapness and efficiency of the structure employed, made an irresistable appeal. It is probable that most of the gardeners will instal similar racks for their own use, thus displacing the present practice of withering over a fire.

Considerable interest was maintained throughout the tour in the field. The gardeners were greatly impressed by the system of seed germinating in

sand beds, and the high percentage of germination obtained in comparison with the methods employed by themselves, i.e. seed beds of ordinary soil.

The area of mature tea caused considerable surprise and appreciation on account of the size and shape of the bushes. Methods of cultivation and pruning were fully explained. In the matter of soil conservation, which is of prime importance on the steep undulating land at Sungei Balak, the construction of contour silt pits had little attraction for the cultivators on the score of expenses, but they were highly interested in the cover crop *Indigofera endecaphylla* as a means to that end.

Apart from the management of tea, the gardeners were very interested in the pure bred pigs, being more attracted by the Middle White than the Large Black.

On the whole, this first demonstration to Chinese gardeners at Serdang was an unqualified success, as apart from the value of any useful information that the gardeners may have acquired, it has gone a long way towards establishing confidence and friendly relations between this Department and a large body of intensely conservative and highly suspicious agriculturists.

## MARKET PRICES.

### May, 1930.

*Rubber.*—The average price of rubber for the month of May was 6.9 pence per lb. London and 23.36 cents per lb. Singapore. This compares with 7.3 pence and 24.68 cents per lb. respectively for the previous month. The fluctuation during May were but slight, the lowest Singapore quotation being 22.75 cents and the highest price 24 cents.

*Copra.*—Average copra prices shew a decline of 16½ cents to $8.63½ per picul for F.M. quality; and a decline of 15 cents to $9.15 per picul for S.D. quality. Singapore shipments for the latter amounted to 1,675 tons.

*Gambier.*—Average Singapore prices for May:—Block $8.38; Cube $16.10 per picul compared with $8.76½ and $18.00 respectively for April, and $8.97 and $15.75 per picul respectively for March.

*Nutmegs.*—A further sharp decline is to be recorded for average Singapore values during May: 110 per lb. $29.60 per picul against $34.00 for the previous month; 80 per lb. $36.20 against $37.65 per picul in April.

*Pepper.*—Singapore prices for black pepper averaged $38.20 per picul compared with $45.00 in April; $51.42 against $55.06 per picul for White Sarawak Shipments 162 tons, black pepper, 153 tons white.

*Rice.*—Singapore average prices: Siam, $370; Saigon, white, $269; Rangoon, white, $249—all per coyan. Corresponding average prices in April were $365.75; $262.75; $244.25.

*Sago.*—Average Singapore prices for May were as follows:—Pearl, fair, $6.37½ (203 tons shipped) compared with $6.50½ per picul in April. Flour $3.85 compared with $3.96 per picul in April, 1,591 tons shipped.

*Tapioca.*—Average Singapore prices for May; Flake, small, fair $4.81 (1,024 tons shipped) compared with $5.32½ in April: Pearl fair, $6.95 per picul, (259 tons shipped) compared with $7 per picul in April.

The above market prices are based on the daily cabled London quotations for rubber; on the Singapore Chamber of Commerce Market Reports covering the period of 21st April to 24th May, 1930, and on other local sources of information.

1 coyan = 40 piculs. 1 picul = 133⅓ lbs.
The dollar has been fixed at 2 shillings and 4 pence

## RETURN OF AREA NEWLY PLANTED WITH RUBBER IN THE FEDERATED MALAY STATES, DURING 1929.

| State. | District. | Area Planted on Holdings. Under 100 acres. Acre. | R. | P. | 100 acres & over. Acre. | R. | P. | Total. Acre. | R. | P. |
|---|---|---|---|---|---|---|---|---|---|---|
| Perak | Bruas & Parit | 1,257 | 1 | 02 | ... | ... | ... | 1,257 | 1 | 02 |
| | Kuala Kangsar | 311 | 1 | 03 | 969 | 0 | 00 | 1,280 | 1 | 03 |
| | Lower Perak | 20 | 1 | 00 | 92 | 0 | 00 | 112 | 1 | 00 |
| | Sitiawan | 120 | 2 | 19 | 452 | 3 | 24 | 573 | 2 | 03 |
| | Kinta | ... | ... | ... | 212 | 2 | 00 | 212 | 2 | 00 |
| | Ipoh | 25 | 3 | 34 | ... | ... | ... | 25 | 3 | 34 |
| | Krian | ... | ... | ... | 470 | 3 | 11 | 470 | 3 | 11 |
| | Upper Perak | 579 | 3 | 04 | 63 | 0 | 00 | 642 | 3 | 04 |
| | Batang Padang | 655 | 3 | 09 | 524 | 3 | 36 | 1,180 | 3 | 05 |
| | Larut & Selama | 2,450 | 0 | 34 | ... | ... | ... | 2,450 | 0 | 34 |
| | Total | 5,421 | 0 | 25 | 2,785 | 0 | 31 | 8,206 | 1 | 16 |
| Selangor | K. Selangor and S. Bernam | 90 | 1 | 02 | 176 | 3 | 12 | 267 | 0 | 14 |
| | K. Lumpur | ... | ... | ... | 191 | 2 | 01 | 191 | 2 | 01 |
| | Klang | 477 | 0 | 00 | 380 | 0 | 00 | 857 | 0 | 00 |
| | Sepang | 193 | 0 | 02 | ... | ... | ... | 193 | 0 | 02 |
| | K. Langat | 347 | 2 | 04 | ... | ... | ... | 347 | 2 | 04 |
| | Ulu Selangor | 934 | 0 | 00 | 123 | 0 | 00 | 1,057 | 0 | 00 |
| | Ulu Langat | 360 | 0 | 00 | 226 | 1 | 00 | 586 | 1 | 00 |
| | Total | 2,401 | 3 | 08 | 1,097 | 2 | 13 | 3,499 | 1 | 21 |
| N. S'bilan | Jelebu | 479 | 2 | 34 | 165 | 0 | 00 | 644 | 2 | 34 |
| | Port Dickson | 1,700 | 0 | 00 | ... | ... | ... | 1,700 | 0 | 00 |
| | Seremban | 512 | 0 | 00 | 1,206 | 0 | 00 | 1,718 | 0 | 00 |
| | Tampin | 1,096 | 1 | 14 | 356 | 0 | 10 | 1,452 | 1 | 24 |
| | Rembau | 178 | 0 | 12 | ... | ... | ... | 178 | 0 | 12 |
| | Kuala Pilah | 0 | 3 | 05 | 147 | 0 | 00 | 147 | 3 | 05 |
| | Total | 3,966 | 3 | 25 | 1,874 | 0 | 10 | 5,840 | 3 | 35 |
| Pahang | Kuantan | 229 | 1 | 17 | 103 | 0 | 00 | 332 | 1 | 17 |
| | Raub | 574 | 0 | 00 | 271 | 0 | 00 | 845 | 0 | 00 |
| | Pekan | 365 | 2 | 36 | ... | ... | ... | 365 | 2 | 36 |
| | Kuala Lipis | 1,212 | 0 | 00 | 680 | 0 | 00 | 1,892 | 0 | 00 |
| | Bentong | 147 | 0 | 00 | 1,696 | 0 | 00 | 1,843 | 0 | 00 |
| | Temerloh | 509 | 0 | 00 | 792 | 0 | 00 | 1,301 | 0 | 00 |
| | Total | 3,037 | 0 | 13 | 3,542 | 0 | 00 | 6,579 | 0 | 13 |

## SUMMARY OF PLANTED AREA (F.M.S.) DURING 1929.

| | Acre. | R. | P. | Acre. | R. | P. | Acre. | R. | P. |
|---|---|---|---|---|---|---|---|---|---|
| Total Perak | 5,421 | 0 | 25 | 2,785 | 0 | 31 | 8,206 | 1 | 16 |
| ,, Selangor | 2,401 | 3 | 08 | 1,097 | 2 | 13 | 3,499 | 1 | 21 |
| ,, N. Sembilan | 3,966 | 3 | 25 | 1,874 | 0 | 10 | 5,840 | 3 | 35 |
| ,, Pahang | 3,037 | 0 | 13 | 3,542 | 0 | 00 | 6,579 | 0 | 13 |
| **Grand Total—F.M.S.** | 14,826 | 3 | 31 | 9,298 | 3 | 14 | 24,125 | 3 | 05 |

J. Gordon-Carrie,

# MALAYA RUBBER STATISTICS.

**Stocks of Rubber including Latex and Revertex held by Dealers and Estates of 100 Acres and Over, the Declared Production of the same Estates, Import and Export Figures, and Estimated Figures of the Production of Estates of Less than 100 Acres, for the Month of April 1930, in Dry Tons.**

| Territory | Stocks at beginning of month | | | Production by estates of 100 acres and over | | Production by estates of less than 100 acres (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ports | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | during the month: Foreign | during the month: From Malay States | during the year 1930: Foreign | during the year 1930: From Malay States | during the month: Foreign | during the month: Local | during the year 1930: Foreign | during the year 1930: Local | Dealers | Estates of 100 acres and over | Ports |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **Malay States** | | | | | | | | | | | | | | | | | | |
| **Federated Malay States** ... ... | ... | 11,730 | 13,038 | 11,137 | 46,740 | 7,785 | 38,876 | ... | 8 | ... | 26 | 13,538 | 5,135 | 64,161 | 23,170 | 11,059 | 13,966 | ... |
| **Johore** ... ... | ... | 2,151 | 4,480 | 3,440 | 14,113 | 3,221 | 15,619 | ... | 1 | ... | 4 | 1,097 | 5,607 | 4,255 | 26,839 | 1,671 | 4,918 | ... |
| **Kedah** ... ... | ... | 420 | 1,863 | 1,971 | 7,644 | 1,004 | 5,273 | ... | ... | 2 | ... | 656 | 2,122 | 2,899 | 10,293 | 356 | 2,124 | ... |
| **Perlis** ... ... | . | 22 | 6 | 8 | 34 | 13 | 57 | | ... | ... | ... | Nil | 29 | Nil | 103 | 14 | 6 | ... |
| **Kelantan** ... ... | ... | 210 | 158 | 316 | 1,160 | 186 | 1,679 | 4 | Nil | 17 | Nil | 76 | 506 | 295 | 2,628 | 176 | 116 | ... |
| **Trengganu** ... | ... | ... | ... | ... | ... | ... | ... | Nil | Nil | Nil | Nil | Nil | 178 | Nil | 759 | ... | ... | ... |
| **Straits Settlements** | | | | | | | | | | | | | | | | | | |
| **Malacca** ... ... | ... | 2,179 | 1,666 | 1,226 | 5,061 | | | Nil | 1,868 | Nil | 5,063 | 3,103 | | 15,223 | | 2,291 | 1,831 | ... |
| **Province Wellesley** | ... | 159 | 505 | 459 | 1,925 | | | | | | | | | | | 106 | 546 | ... |
| **Dindings** ... ... | ... | 123 | 134 | 78 | 368 | *6,563 | 14,257 | 864 | 2,974 | 3,495 | 13,852 | 4,759 | Nil | 23,336 | Nil | 101 | 118 | ... |
| **Penang** ... ... | 1,404 | 5,305 | 8 | 11 | 40 | | | | | | | | | | | 5,374 | 11 | 1,964 |
| **Singapore** ... | 3,662 | 31,734 | 345 | 203 | 946 | | | 10,037 | 8,726 | 38,773 | 44,847 | 22,288 | | 84,567 | | 33,265 | 348 | 4,128 |

**Analysis of Colony and Federated Malay States Dealers' Stocks at End of Month. in Dry Tons.**

| Class of Rubber | Federated Malay States | Singapore | Penang | Province Wellesley, Dindings and Malacca | Johore | Gross total |
|---|---|---|---|---|---|---|
| (20) | (21) | (22) | (23) | (24) | (25) | (26) |
| Smoked sheet ... | 8,353 | 13,254 | 3,645 | 1,466 | 700 | 27,418 |
| Crepe ... ... | 637 | 17,002 | 786 | 715 | 171 | 19,311 |
| Unsmoked sheet ... | 966 | 3,009 | 943 | 317 | 415 | 7,138 |
| Scrap and lump ... | 1,103 | | | | 385 | |
| Total all Grades ... | 11,059 | 33,265 | 5,374 | 2,498 | 1,671 | 53,867 |

*Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19)—(2)—(3)—(4)—(5)—(9)—(10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated April 10. The ratio of the reduction on wet rubber, taken from Dealers' returns, is 33.4% for Singapore and 26.4% for Penang.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I. & E. 5, dated May 3, reduced to dry weight by the percentages for April in Note 3; (*S.S. Gazette* Notification No. 919/1930).

6. Foreign exports are those of each State and Settlement as published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I. & E. 4, dated May 6.

7. The State of Trengganu has no organisation at present for the collection of returns of stocks and production; the latter can be estimated as approximately equivalent to exports.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.

*9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the Columns composing it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

Kuala Lumpur,
*Singapore, May, 19, 1930.*

J. I. Miller, M.C.S.,
*Acting Registrar-General of Statistics, S.S. and F.M.S.*

## SUMMARY OF PADI RETURNS OF MALAYA FOR THE PERIOD OF APRIL, 1930.

| State | Locality | Acreage of Padi Land | | | Acreage planted current season | | | Stage of Cultivation | Estimated Crop Harvested | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Acres | R. | P. | Acres | R. | P. | | | |
| **S.S.** | Singapore | — | — | — | — | — | — | — | — | — |
| | Malacca (Total) | 35,499 | 0 | 00 | 29,648 | 0 | 00 | Harvesting completed. | Total yield 10,073,821 gantangs. | Prospects of crop in all districts of Malacca are good except Alor Gajah, Coast and Jasin Inland mukims which were affected by late planting, short of water and flood damage. |
| | P. Wellesley (Total) | 39,640 | 0 | 00 | 38,120 | 0 | 00 | Harvesting completed in all areas except P. Wellesley South which is progressing. | Total yield 5,939,997 gantangs. | Scattered area not included —560 acres. Yield 45,000 gantangs. Dry padi 350 acres—crop below average being insufficient water during growing period. |
| | Penang | 4,000* | 0 | 00 | 2,842 | 0 | 00 | Harvesting completed. | Total yield 1,201,500 gantangs. | Prospects fair. Irrigation available to limited area. Rats and stem borers have caused lot of damage. |
| | TOTAL:—S.S. | 79,139 | 0 | 00 | 70,610 | 0 | 00 | | Total 17,215,318 gtgs. | * About 1,100 acres of this area are now planted with coconuts and rubber. |
| **Perak** | North | 53,250 | 0 | 00 | 46,660 | 0 | 00 | About 13,500 acres harvesting in progress, balance completed. | | Krian will most certainly prove to be below average. No estimate therefore can be given regarding yield at present. Crop in Briah, Selinsing and Gunong Semanggol is poor; the last two mukims will not produce any crop. |
| | K. Kangsar | — | — | — | — | — | — | — | — | Kuala Kangsar, March returns completes the information for this season until returns are to hand from Land Offices of total crops actually harvested by the cultivators. |

## SUMMARY OF PADI RETURNS OF MALAYA FOR THE PERIOD OF APRIL, 1930.—(Continued)

| State | Locality | Acreage of Padi Land | | | Acreage planted current season | | | Stage of Cultivation | Estimated Crop Harvested | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Acres | R. | P. | Acres | R. | P. | | | |
| | Larut - | 11,975 | 0 | 00 | 11,725 | 0 | 00 | Harvesting nearly completed. | Total yield 2,303,750 gantangs. | |
| | Upper Perak - | 3,877 | 0 | 00 | 3,739 | 0 | 00 | Harvesting completed. | Total yield 1,251,700 gantangs. | Upper Perak. Acreages given differ from those given in last month's return. These are nearly correct as obtained at present but it is hoped more accurate acreage will be obtained next season. |
| | TOTAL: PERAK | 69,102 | 0 | 00 | 62,124 | 0 | 00 | | Total yield 3,555,250 gantangs. | Scattered area—nil. Dry padi—201 acres only in Upper Perak. |
| Selangor | K. Selangor - | 13,410 | 0 | 00 | 13,410 | 0 | 00 | Completely destroyed owing to lack of water and pest damage. | | Note. Except Kuala Selangor, all other areas have previously been dealt with. |
| Negri Sembilan | All Districts - | 37,296 | 0 | 05 | not yet planted | | | Preparing sawah. | | |
| Pahang | West Area - | 12,311 | 0 | 00 | | | | Nurseries. | | |
| | East Area - | (Return by Quarterly only) | | | | | | | | |

(Sd.) W. GORDON CARRIE,
D.R.G.S.,
*Statistician.*

# METEOROLOGICAL SUMMARY, MALAYA.

## APRIL, 1930.

| Locality | Air Temperature in degrees Fahrenheit: Means of A. Max. | Means of B. Min. | Mean of A and B | Absolute Extremes: Highest Max. | Date | Lowest Min. | Date | Lowest Max. | Date | Highest Min. | Date | Earth Temperature: At 1 foot | At 4 feet | Rainfall: Total | Total | Most in a day: Amt. | Date | Number of days: Precipitation* | Precipitation, 1mm. or more | Thunder-storm | Thunder heard | Fog morning obs. | Gale force 8 or more | Bright Sunshine: Total | Daily Mean | Length of Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | °F | °F | | °F | | °F | | °F | | °F | °F | in. | mm. | in. | | | | | | | | hr. | hr. | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 93,0 | 73,0 | 83,0 | 96 | Several | 71 | Several | 89 | 8, 24 | 75 | Several | 84,7 | 84,8 | 10,01 | 254,3 | 1,72 | 27th | 20 | 16 | 6 | 24 | 6 | | 213,85 | 7,13 | 12,2 |
| Bukit Jeram, Selangor ... | 91,9 | 73,4 | 82,7 | 98 | 2nd | 71 | " | 86 | 8th | 76 | 8th | 89,0 | 89,9 | 4,75 | 120,7 | 1,87 | 30th | 13 | 10 | 1 | 20 | 2 | | 236,95 | 7,90 | 12,2 |
| Sitiawan, Perak ... | 90,9 | 73,1 | 82,0 | 95 | 2, 3 | 71 | 16, 18 | 86 | 22nd | 76 | 8, 29 | 84,7 | 84,4 | 6,88 | 174,76 | 1,51 | 30th | 18 | 16 | 17 | 27 | ... | | 235,25 | 7,84 | .. |
| Kroh, Perak ... | 89,8 | 70,9 | 80,3 | 95 | 4th | 66 | 17th | 78 | 14th | 75 | 23rd | 83,1 | 84,3 | 6,77 | 172,6 | 1,20 | 20th | 17 | 13 | ... | 16 | .. | | 243,65 | 8,12 | ... |
| Temerloh, Pahang ... | 93,3 | 73,0 | 83,1 | 97 | 9, 12 | 70 | 5, 11 | 91 | Several | 76 | 12th | 87,3 | 86,9 | 6,86 | 174,2 | 3,07 | 10th | 10 | 7 | 1 | 23 | 5 | | 231,50 | 7,72 | 12,2 |
| Kuala Lipis, Pahang ... | 90,8 | 72,1 | 81,5 | 95 | 1, 10 | 70 | Several | 88 | 28th | 74 | Several | 84,4 | 83,8 | 11,17 | 283,7 | 1,60 | 25th | 18 | 16 | 19 | 21 | 15 | | 232,65 | 7,75 | ... |
| Kuala Pahang, Pahang ... | 88,2 | 75,4 | 81,8 | 92 | 13th | 72 | 26th | 85 | 14th | 81 | 2, 3 | 87,4 | 87,0 | 3,58 | 90,9 | 1,03 | 13th | 14 | 10 | 2 | 7 | ... | | 253,30 | 8,44 | 12,2 |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 73,3 | 60,1 | 66,7 | 77 | 5, 25 | 57 | 3rd | 69 | 14th | 61 | Several | ... | ... | 13,51 | 343,2 | 1,86 | 10th | 22 | 21 | 10 | 25 | 5 | | 168,10 | 5,60 | 12,2 |
| Cameron's Highlands, Tanah Rata ... | 74,1 | 55,4 | 64,7 | 77 | 11, 25 | 48 | 16th | 71 | 14th | 60 | " | 69,4 | 69,0 | 12,47 | 316,7 | 1,34 | 10th | 22 | 22 | 10 | 25 | 1 | | 159,25 | 5,31 | 12,2 |
| Fraser's Hill, Pahang ... | 75,1 | 62,5 | 68,8 | 81 | 25th | 61 | Several | 71 | 10th | 64 | " | 72,7 | 72,5 | 7,61 | 193,3 | 1,04 | 14th | 19 | 15 | ... | 26 | 28 | | 180,90 | 6,03 | 12,2 |
| Mount Faber, Singapore ... | 88,5 | 75,1 | 81,8 | 92 | Several | 72 | 6, 7 | 82 | 11th | 79 | 27th | 82,1 | 83,3 | 9,91 | 251,7 | 2,50 | 10th | 15 | 11 | ... | 16 | ... | | 194,00 | 6,47 | 12,2 |
| Butterworth, Province Wellesley ... | 89,7 | 75,5 | 82,6 | 94 | 2nd | 73 | Several | 86 | 22, 27 | 78 | 13th | 87,7 | 86,1 | 11,45 | 290,8 | 2,98 | 1st | 13 | 11 | 1 | 14 | 1 | | 253,05 | 8,43 | ... |
| Bukit China, Malacca ... | 87,0 | 74,5 | 80,7 | 92 | 2nd | 72 | 14th | 84 | Several | 76 | Several | 83,7 | 84,6 | 9,84 | 250,0 | 4,05 | 13th | 15 | 14 | 5 | 9 | ... | | 219,10 | 7,31 | 12,2 |
| Kluang, Johore ... | 90,2 | 71,8 | 81,0 | 93 | 12th | 70 | Several | 86 | 7, 23 | 74 | 4th | 82,8 | 83,1 | 8,29 | 210,6 | 2,71 | 28th | 17 | 15 | 3 | 20 | 18 | | 198,85 | 6,63 | 12,2 |
| Bukit Lalang, Mersing, Johore ... | 88,7 | 72,7 | 80,7 | 91 | Several | 70 | 15th | 84 | 11th | 75 | 2, 23 | 82,6 | 81,8 | 6,02 | 152,9 | 1,85 | 13th | 13 | 10 | ... | 16 | ... | | 231,45 | 7,71 | 12,2 |
| Alor Star, Kedah ... | 91,9 | 73,6 | 82,7 | 95 | " | 70 | 17th | 87 | 24th | 77 | 23rd | 87,5 | 87,3 | 5,52 | 140,2 | 1,44 | 18th | 17 | 13 | 3 | 20 | ... | | 268,60 | 8,95 | ... |
| Kota Bharu, Kelantan ... | 90,6 | 73,3 | 81,9 | 94 | 27th | 70 | 16th | 85 | 18th | 76 | 27th | 84,7 | 83,8 | 1,49 | 37,9 | 0,69 | 17th | 5 | 4 | ... | 1 | ... | | 276,60 | 9,22 | ... |
| Kuala Trengganu, Trengganu ... | 89,5 | 73,1 | 81,3 | 93 | 13th | 71 | Several | 88 | Several | 75 | Several | 84,9 | 85,1 | 1,14 | 29,0 | 0,34 | 18th | 8 | 6 | ... | 6 | 3 | | 283,75 | 9,46 | ... |

*Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

# Malayan Agricultural Journal.

Vol. XVIII. JULY, 1930. No. 7.

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THE

# Malayan Agricultural Journal

JULY, 1930.

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## EDITORIAL.

**Animal Husbandry in Malaya.** The appearance of an article in this issue of *The Malayan Agricultural Journal* on the Friesian Holstein breed of cattle offers an opportunity for some comments on the general position of animal husbandry in Malaya.

One of the outstanding weaknesses of the economic position in this country is the extent to which it is dependent on imported food; this applies not only to staples such as rice, but also to animal products. To illustrate this, it may be pointed out that the nett imports of condensed and sterilised milk amounted in 1929 to 1,334,396 cases valued at $14,108,144, those of butter amounted to 15,659 cwts. valued at $1,172,144, those of dead meat amounted to 2,761 tons valued at $2,024,563, whilst the imports of live animals amounted to 345,999 head valued at $11,110,856. The total value of imports under all these heads amounted to $28,415,677. The figures in this respect are steadily rising and during the past five years have increased by $6,750,000.

Compared with neighbouring countries the total is enormous. For example, in Ceylon in the year 1925 the combined value of imports of dairy produce, tinned and frozen milk, butter, cheese, dripping and lard amounted only to Rs. 2,320,850, whilst the combined imports of cattle, sheep, goats and buffaloes amounted to 90,973 head only.

The dependence of the country on importations of animal produce in this way is a serious source of weakness, while natural conditions supply no reason why the existing state of affairs should be such as it is. The position is almost certainly the outcome of the rapidity with which development has taken place which has led to attention being concentrated on the production of highly profitable export products to the almost total neglect of products of animal husbandry; but while such a state of affairs is natural and comprehensible during periods of rapid development, it is extremely unsound as a general economic proposition, and serious attention to measures which can be adopted for its alleviation seems to be needed.

No doubt it is a matter of difficulty to change the view of a population of which the vast majority have become habituated to the existing state of affairs, but nevertheless this does not alter the fact that the present position is abnormal

and dangerous and that with the continuation of lower prices for exports it is liable to lead to considerable distress and difficulties.

In this connection, milk supplies stand out prominently as a subject calling for attention. The actual milk production in the Peninsula compared with the consumption is infinitisimal, but where dairy enterprises have been carried on, sufficient data have been accumulated to show that conditions in Malaya present no radical differences from those encountered, for instance, in Ceylon, Java or Sumatra where dairying is practised on a comparatively extensive scale. In considering steps for the development of dairying in Malaya, it is desirable that the country should profit, so far as possible, from the experience obtained in other places. Attention may be called to the outstanding results which have been obtained under tropical conditions with Friesian cattle, both as pure strains and more particularly as crosses with native cows. The experience obtained in a number of tropical countries indicates quite clearly the satisfactory nature of the results which have been obtained practically everywhere this breed has been tried.

Furthermore, one may point to the abnormally high prices which at present prevail in Malaya for fresh milk. Ordinarily 40 to 60 cents of a dollar are charged per quart of fresh cow's milk. Compared with standards in other countries this is extremely high; thus in Mauritius it was found that the Government dairy milk equal in quality to grade 'A' milk in England could be produced at a cost equivalent to 20 cents (Straits) per quart, whilst at the Government Dairy in Ceylon milk is sold at a price equivalent to 40 cents per quart.

While admitting that the cost of living in Malaya probably entails that retail prices for milk should tend to be higher than elsewhere, the discrepancy between these figures and prices charged elsewhere is so great that one cannot avoid the conclusion that if operations were conducted on a proper scale, tropical milk production could be undertaken at a very much lower figure than that which prevails at present.

One of the difficulties in relation to the production of milk in the tropics has been that of the conditions under which native cow keepers house their animals and produce milk. The native cow house is usually badly constructed and the conditions are insanitary. In Malaya, sanitary requirements have attained a considerably higher standard in certain respects than in some of the adjoining countries and it is possible that this may partly account for the failure of milk supply to extend up to the present.

The existence, however, of such conditions paves the way for the introduction of better standards once dairying becomes more generalised and in this connection, allusion may be made to the very interesting system of providing a central milking place under official supervision for cows kept by Tamil labourers attached to the Sanitary Board at Ipoh. It is hoped at a later date to publish an account of this in the *Malayan Agricultural Journal.*

Another difficulty which at present lies in the way of increasing dairying is the provision of suitable areas of pasturage. As against this must be set the

fact that large areas of abandoned mining lands exist which at present, except where they have been taken over and converted into Chinese market gardens, are arid and unprofitable wastes. It seems worthy of consideration whether some means might not be found for utilising some of these lands for conversion into pasture.

The Department of Agriculture, during the past three years, has been experimenting at Serdang with the production of milk. The recently approved proposal for the establishment of a small modern dairy for supplying milk to the hill station at Fraser's Hill is also an interesting move in the same direction. The need would appear to be, however, for more concerted action on a larger scale with a view to solving this urgent though difficult problem of replacing the present large import of cattle and dairy produce by local production.

**Cinema Films and Agricultural Propaganda.** The decision of the Federated Malay States Government to give effect to certain recommendations which were put forward as the result of the Agricultural Field Officers' Conference held in October last relative to the organisation of a Propaganda Van, which will tour the country for the purpose of exhibiting propaganda and instructional films, displaying suitably organised exhibits and providing for the delivery of short lectures on suitable subjects to native agriculturists, marks an important step in advance. The scheme has now been fully worked out and the necessary funds provided for the preparation of films, for the organisation of the van and exhibits and for the operation of the undertaking.

The scheme is being operated jointly by the Department of Agriculture, the Department of Co-operation and the Rubber Research Institute of Malaya. Its inception was due in the first instance to the preparation of two propaganda films by officers of the Co-operative Department which were intended to inculcate by means of simple stories the principles and objects of co-operation. The success achieved in this preliminary experiment led to the formulation of the larger plan which it is anticipated will be in working order in the course of the next two or three months.

The scheme is administered by a small committee consisting of the Directors of Agriculture and of Co-operation and the Director of the Rubber Research Institute, of which the Director of Co-operation is Chairman, while Departmental Sub-Committees have been formed for the purpose of dealing with the details of the work contributed by each Department to the joint undertaking. Similar travelling exhibits have already attained considerable popularity in other countries. In India, the Department of Agriculture of the Madras Presidency has organised a van of this description and satisfactory results are reported to have followed its inauguration. It is hoped that the new venture may in due course prove its value in Malaya. It is proposed to publish an account of the equipment of the van in a subsequent issue of this journal.

**Oil Palms.** The present position of the oil palm industry is reviewed on another page of this number. The figures shew that the growth of the industry has been slow but steady while there is evidence of a policy on estates of further development for some years to come. Local production of palm oil and palm kernels will increase more rapidly than hitherto as large areas are about to come into bearing, while much of the area already in bearing has not yet reached the stage of maximum production.

In the Netherlands East Indies, the cultivation of the oil palm has been taken up more extensively than in Malaya. While we can only claim 32,000 acres planted, we believe that the neighbouring Dutch Colony has planted an area of over 125,000 acres. Furthermore, their exports now exceed 30,000 tons annually and are still rapidly increasing.

The present state of the plantation oil palm industry and the developments which appear likely, indicate that the time is not far distant when this product will exercise a considerable influence on the oil markets.

# Original Articles.

## FRIESIAN CATTLE

### With some Records of their History in the Tropics.

BY

T. D. MARSH,
*Assistant Agriculturist.*

The origin of Friesian cattle is obscure, but apparently herds were in existence in north-west Europe at the time of the Roman Conquest. The Province of Friesland in north-west Holland is the home of this breed, and is probably the source of the stock that has been distributed throughout the world during recent times.

Friesians are almost always black and white in colour. The mature stock attain to a large size, the bulls at maturity often scaling over one ton in weight. It is essentially a dairy breed, the cows producing a large quantity of milk. Friesian cattle have gained the reputation of being the premier milk-producing breed in the world. These cattle have also the reputation of being amongst the most economical producers of milk and of total solids contained in the milk and in experiments in Wisconsin, in competition with other breeds, their production has been higher for the amount of food consumed than that of Jerseys and Guernseys. Moreover, they are noted for their ability to consume and turn into milk large quantities of rough fodder and bulky food.

Criticism of this breed in the past has been that the percentage of butter fat often fell below legal standards, necessitating the keeping of a few Channel Island cows in the herd in order to maintain the percentage of fat in the bulked milk up to the standard required by law. The modern tendency in Friesland is to breed cattle that yield a fairly large quantity—but not a phenominal quantity—of milk, with a percentage of fat between 3½ and 4.

A further criticism of Friesian cattle is directed to their liability to tuberculosis. The several Friesian Cattle Associations in Holland and Germany, whose object it is to control and improve the breed, have realised this weakness, and a rigid tuberculin test is carried out by most Friesian Societies to exclude from the herd books the registration of diseased animals. Much care and attention has also been given towards the improvement of the general health of the animals.

There are several associations in Holland and North Germany that control the breeding of Friesian types of cattle. These breeding societies have each

their ideal type of animal, which it is their aim to perfect. Some variations from the Friesian cattle of Holland are being developed by such societies, as they maintain that the breed should be described as a dairy-general purpose animal on account of the fact that the animals fatten readily and the calves are economical to feed for the production of veal.

Cattle from Holland have been imported into England for the past two centuries and it is recorded that Friesland cattle were used to cross with the native British cattle in the establishment of the Shorthorn breed.

The British Friesian Cattle Society, which was founded in 1909, has done much towards the improvement of the breed in Britain, especially in the direction of uniformity of type and general advancement in productivity. One herd of cattle has produced fifteen 2,000 gallon cows, five of which repeated their yields for two consecutive years, while three cows gave 2,000 gallons or more for three successive periods of 365 days. In 1924 this herd of cows averaged 1,530 gallons per cow.

The breeding of Friesian cattle in Britain for the export trade of pedigree stock has, since 1922, been seriously affected by outbreaks of Foot and Mouth disease. Since that date, however, strict quarantine conditions have been instituted which ensure the export of only healthy animals.

It is said (1) that the Holstein Friesians represent almost 60 per cent. of the better dairy stock in America, they are rapidly increasing in numbers in Britain and Australia, whilst in South Africa they have in addition to their intrinsic merits, their country of origin to influence their popularity. They have been tried with success in the West Indies, Mauritius, Hong Kong, India, Java, and Ceylon. Friesian cattle hold most of the world's records for milk production, and even though the percentage of butter fat in their milk is low, they often hold the records for butter fat production because of their heavy milk yields.

## Friesian Cattle in South Africa.

In South Africa, the Friesian breed—which was introduced by the Dutch many years ago—has become very firmly established and constitutes by far the most important breed of milch cattle in the Union. It is extensively bred both in the Cape Province, the elevated regions of the central plateau and in the sub-tropical coastal regions of Natal.

The breeding of this strain has been controlled on systematic lines for many years and the South African Friesian Association maintains both individual and herd registers for pedigree animals and herds bred in the Union.

The South African strain of Friesian is well known throughout the world and probably constitutes the most outstanding example of the acclimatisation of a European dairy breed under sub-tropical conditions.

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(1) E. J. Cooper, Holstein-Friesian Association of America.

## Friesian Cattle in Australia.

Every year sees the Friesian breed of cattle becoming more widely distributed throughout Australia. In the sub-tropical conditions of Queensland there are over one hundred recognised Friesian breeders.

It must be appreciated that the production and export of butter principally supports the dairying industry of Australia and for this reason both in that country and in New Zealand, the policy of cattle breeders has been to increase the fat content whilst at the same time maintaining and improving the yield of milk.

The Friesian holds the records for butter fat as well as for milk production at least in Victoria, which is the premier dairying State of Australia. In view of the Friesian reputation regarding poorness of milk compared with other breeds, these are remarkable records.

## Friesian Cattle in Mauritius.

A Government dairy of over 50 cows was established in Mauritius in 1924 by the importation of specially selected high grade Friesians from South Africa. This dairy was started (2) for educational and demonstrational purposes, and to undertake commercial dairying to supply milk to hospitals, Government institutions and private individuals. The site of the farm was selected at an altitude 1,900 feet above sea-level at Curepipe Camp, where a suitable area of pasturage was available. Mauritius lies approximately on 20 degrees of latitude South. The rainfall is about 110 inches per annum, the mean maximum temperature is 73.9°F., and the mean minimum 61.2°F.

The cattle were housed in substantial stone houses with up-to-date fittings, such as iron stanchions and automatic water supply to each animal.

The main average lactation period was found to be 341 days, whilst the average yield per cow was 2,404 litres (528 gallons), the maximum recorded was 5,200 litres (1143 gallons). The results demonstrated that the Friesian breed is well adapted to the conditions at Curepipe in Mauritius. The establishment of this dairy was a complete success, and at the time the reports were written from which these notes are taken, it was proposed to increase the number of milking cows to 100 head. In contrast, it was found previously that Jerseys were liable to pneumonia, apparently owing to the high atmospheric humidity.

## Friesian Cattle in Ceylon.

The following extract is taken from a paper (3) by a dairy farmer in Ceylon whose farm is situated at Kurunegala about 500 feet above sea-level, and is

(2) The Milk Supply of Mauritius :—(a) H. A. Tempany, D.Sc. (b) N. Craig, M.Sc. (c) Y. Lefebure.

(3) Dairy Farming and Breeding of Stock in the Kurunegala District, Ceylon ; M. A. Fernando, M.A. (Cantab). Tropical Agriculturist, Vol. LXX, page 363.

approximately in latitude 7° North. The average humidity is about 78 per cent., the mean temperature is approximately 81°F. with practically no monthly variation, the rainfall being about 70 to 75 inches per annum.

"Importation of British Friesian pedigree bulls for stud have taken place since 1921. The stock bred during the past seven years from these Friesian sires are thriving wonderfully and, as for hardiness, the Friesian half-breds and three-quarter breds are not behind the ordinary village cattle of the district."

"This is a great point in favour of the Friesian breed. Cross-bred Jersey and Ayrshire cattle are if anything rather delicate when reared in the low-country. The half-bred Friesian cows now in milk are much superior to their dams, not only in the yields they give but in the duration of the lactation period. I have not had the opportunity yet to test the milk yields of any of my three-quarter bred Friesian heifers, as the oldest of the second generation heifers have yet to calve. I am confident that these will easily eclipse their dams as milkers. The success so far attained points clearly to the fact that in four or five generations, a grade of cows can be bred which approximate closely to the pure-bred Friesian. These results have been obtained by systematic grading of my milking herds, that is to say, all unthrifty, aged, and comparatively poor milking animals are weeded out annually."

"Another problem that has to be faced in Ceylon when one goes in for cross breeding is the utilisation of the bull calves so bred. Fattening for the butcher is out of the question as the local price of beef will not leave the fattener or grazier with any margin of profit. I use the great majority of my cross-bred bulls for draught purposes and I find that they make excellent cart bulls. They certainly draw a bigger load than the ordinary Sinhalese cart bull and I find they are just as hardy even in the low-country. It is in this respect that I found the cross-bred Jersey and Ayrshire bulls failed. They seem to feel the heat in the low-country while on the open road, and the type of animal is not suited for drawing big loads, as invariably their backs are wedge-shaped and poor in muscle. The cross-bred Friesian bulls can be put to the cart at three years of age, whereas Indian bulls cannot be trained until they are at least four years old."

## Friesian Cattle in India.

The following paragraphs are extracts from an article (4) entitled "Cross-breeding and Grading of Cattle in India" at Allahabad. Allahabad is situated in the Central Province at a latitude of approximately 25° North.

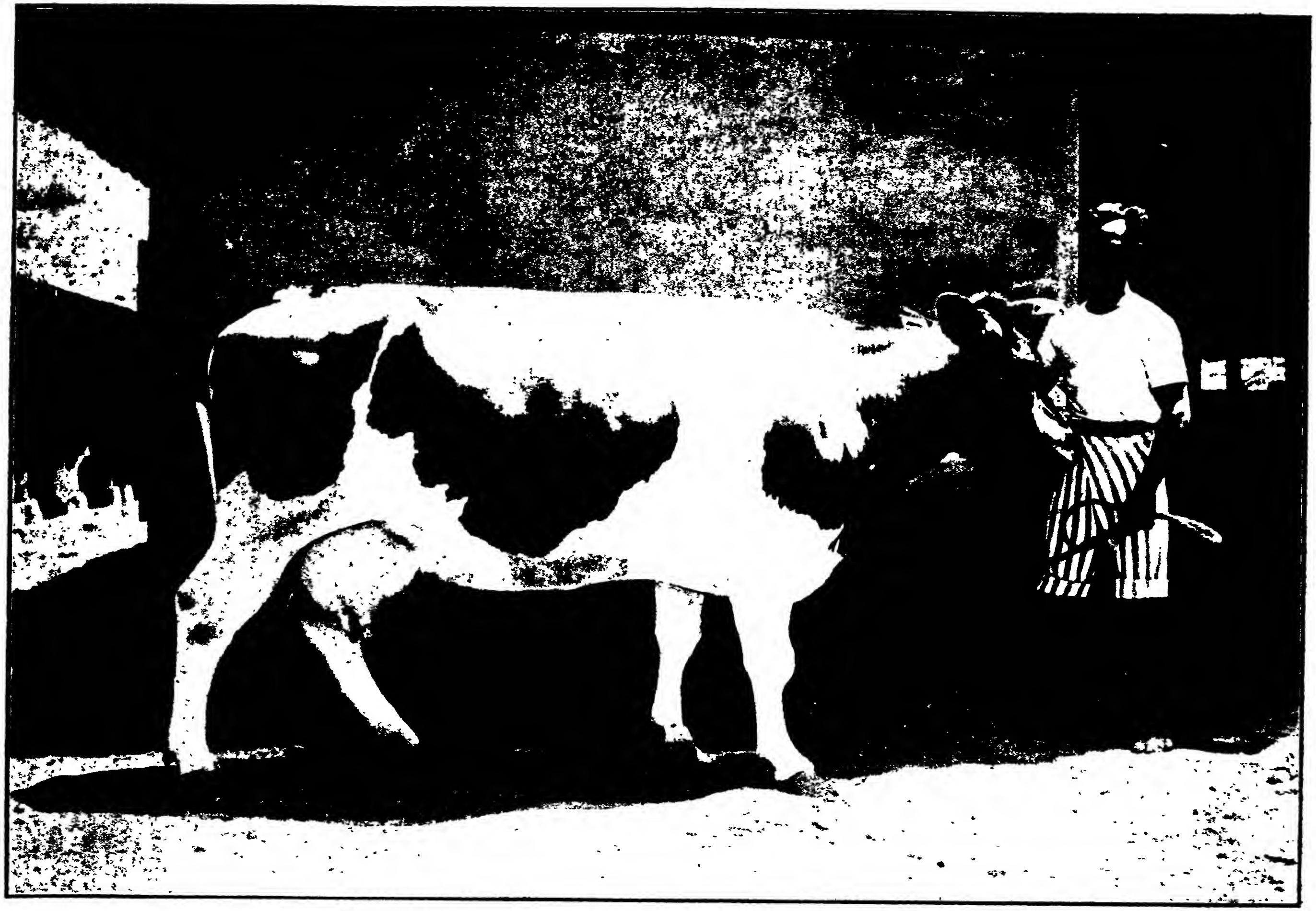
"It may be said that the Holstein-Friesian is better than the Holstein-Ayrshire."

"$\frac{3}{4}$ Friesian has proved to be better than $\frac{1}{2}$ Friesian."

"$\frac{7}{8}$ Friesian has proved to be animals of good constitution and good milkers."

(4) K. W. Forman, Animal Husbandry and Dairying in India. Vol 1, page 108.

JAVA-BRED FRIESIAN BULL.



Java-bred Friesian Cow.

"Friesian-Hariana half-bred and grades average 10,000—15,000 lbs. milk. Ayrshire-Sahiwal half breds and grades average 3,000 to 9,000 lbs. of milk."

"Friesian-Sahiwal half-breeds and grades average 8,000 to 10,000 lbs. milk, Ayrshire Sahiwal half breds and grades average 3,000 to 9,000 lbs. of milk."

"Many instances go to prove that the Friesian is superior to the Ayrshire in crossing and grading up with the Indian breeds."

"Half-bred Friesian bulls have been successful in grading up their progeny when mated with Indian cattle."

"A very interesting experiment of crossing half-bred cows to country bulls showed that the progeny were poor milkers, but when country cows were crossed with half-bred Friesian bulls the progeny turned out to be good milkers. This seems to indicate that the sires in both cases were more prepotent than the dams, in spite of the fact that in the second case the sire was a half-bred Friesian. When ¼ European cows (Friesian or Ayrshire) were crossed with country bulls, the results were poor, giving a ⅛ cross averaging 6 lbs. daily. When the same cows were crossed with a ¾ Friesian bull, the results were good, when crossed with pure Friesian bulls it gave ⅝ crossed averaging 28 lbs. daily. The ¾ Friesian bull had to have a half-bred Friesian bull as a sire. He could not be the descendant of a country sire and a half-bred Friesian dam in order to make any improvement. This all goes to prove that if one knows the breeding of his Friesian bulls, even if they are not pure-bred, he can get fairly good results. Of course it is always safer to use the pure-bred animal. If, however, the Holstein-Friesian proves to be worth while for grading purposes, it would be better for a beginner to start with a grade-bull and then to follow up with a pure-bred Friesian bull rather than delay until he can afford to buy a pure-bred Friesian bull."

## Friesian Cattle in Hong Kong.

The following few notes are observations of the Manager of the Dairy Farm, Ice and Cold Storage Co., Ltd., Hong Kong. This farm is situated at an altitude of about 600 feet above sea-level. The latitude is approximately 22° North.

The mean summer temperature is said to be about 82°F. and the mean winter temperature about 60°F.

The humidity is high, the rainfall being about 84 inches and is seasonal, the bulk of it falling between May and September.

The breeds of cattle found most suitable are pure-bred Ayrshire and pure-bred Holstein and crosses between the two both ways.

The Holstein-Ayrshire is the better cross, the Ayrshire-Holstein produces quite a good grade cow.

Pure-bred Shorthorns have been tried and found to be unsatisfactory.

## Friesians in the Dutch East Indies.

The Director of Agriculture, Industry and Commerce, Buitenzorg, Java, in a recent communication makes some interesting observations regarding the Friesian in the Dutch East Indies. The following are the main points in his letter.

Full-bred Friesian cattle are seldom reared in the Netherlands East Indies. A number of farms in Java, mainly situated in the mountainous districts of the Preanger Regencies (West Java) and in North Banjoemas (Central Java) have for many years past been occupied in crossing the original stock with bulls imported from Holland. In addition, a few of these farms have, for the past twenty years, been importing a small number of full-bred Friesian cows and heifers with the intention of rearing their own male breeders.

Many of these farms are of considerable size. For instance, two farms near Bandeong (West Java) each have herds of over 600 head. One farm near Poerwokerti (Central Java) with over 200 head of cattle, possesses an excellent quality of fairly uniform milk-yielding stock of preponderant Friesian blood. The average milk production is about 15 to 20 litres per day. All these farms are situated at an altitude of about 700 to 1,300 metres (2,300 feet to 4,266 feet).

Full grown animals, and generally also the calves, are kept to the cow-sheds owing to the danger of blood diseases, such as anaplasmosis, piroplasmosis and surra. In a few farms, however, it is the practice to allow the calves and young cattle a few hours of liberty in the field.

The farms deliver considerable quantities of milk to the large cities, such as Bandoeng, Batavia, Semarang, Sourabaya, etc., yet without being able entirely to satisfy the existing demand. This is generally due to the lack of cooling-plants, refrigerator cars, and easy rapid communication from the farms to the cities.

In consequence of this transport difficulty, a large number of smaller enterprises have become established in the vicinity of the cities and now take an active part in milk production and distribution. The small farms are generally situated in the warm plains. They rarely breed their own cows, but purchase them from the larger farms on the hills or elsewhere. As a rule they are of poorer quality than the stock owned by the large farms.

The cattle of these farms, however, generally are situated in the warm plains. From the year 1914 onwards Government has made an effort to improve conditions by procuring on easy terms for the use of the smaller and less favourably situated farms, bulls kept for covering (high bred animals which resulted from cross-breeding, of next to pure Friesian blood) originating from mountain farms. During the past 10 years, about fifty such stud bulls have been distributed annually.

In Java, and more so in the other Islands of the Archipelago, the consumption of fresh milk is very small. The native population abstains from drinking

JAVA-BRED FRIESIAN BULLS.

milk as a rule, while a large portion of the European population often prefers the imported canned milk to fresh milk.

Dependent upon the existing competition, the price of milk varies considerably, viz. from f.o. 15 to f.o. 0.30 bottle containing 750 grams or ¾ Litre (one Litre = 1¾ pints).

Finally, the fact should be stressed that a large percentage of the cattle in the Netherlands East Indies consists of valuable stock of Dutch-Native cross breeds.

## Friesian Cattle in the West Indies.

In reports from Trinidad 1929, (5) it is stated that in 1923 Friesian cattle were definitely selected for grading up dairy stock at the Trinidad Government Farm. Trinidad is between the 10° and 11° latitude North.

" The Friesian was selected because of the excellent results obtained from the half-bred Friesians, the result of the breeding of an imported pure-bred Friesian bull. Another reason was that the well-marked dairy characteristics of the Friesian showed themselves in a remarkable way when grading up cattle with a high percentage of Zebu blood.

" Friesians in addition are easy to handle and are very docile, while in the case of the half-breeds the calves can easily be removed at birth and hand reared.

" Since then a system of grading up has been adopted, the stage has been reached where the three-quarter bred Friesian are now in milk and the results show that an improvement has been achieved in each stage upwards. The work, however, is not confined solely to grading up, as animals of the same grade are bred together.

" The following grades exist at present in the herd, viz. half-breeds obtained by a pure-bred sire, half-bred the progeny or half-bred parents, and three-quarter bred the progeny of number one, and number two, with a pure-bred sire. It is hoped this year to breed together selected three-quarter bred.

" It has really been wonderful to see what a marked improvement in the dairy qualities of a cow even a half-bred Friesian bull can impart. For a number of years both at the farm and at the public pastures half-bred Friesian bulls have been standing for service and this progeny, cattle with 25 per cent Friesian blood have been a marked improvement on the ordinary native dairy cow."

## Friesian Cattle in Malaya.

Malaya is situated approximately 1 to 7 degrees north of the Equator. The average annual rainfall at the Government Experimental Plantation, Serdang in Selangor where the Friesian and other stock are kept, is 93 inches, the mean

(5) Dairying in the Tropics. H. V. M. Metiver, O.B.E., B.Sc., M.R.C.V.S., Tropical Agriculture, Vol. VI, page 3.

maximum temperature 91°F. and the minimum mean temperature 72°F. The Plantation is about 160 feet above sea level, and 3° north of the Equator.

Two young Friesian bulls were imported by the Federated Malay States Government towards the end of 1929. They are stationed at the Government Experimental Plantation, Serdang, and up to date they have been healthy and are doing well.

These bulls were imported from Hong Kong and are a mixture of Canadian and Holland blood of high milking strains. They are being used to cross with the Sahiwal or Montgomery breed of Indian cows on the Plantation.

It is proposed in the near future to import Friesian incalf heifers from Australia for trial at the Government Experimental Plantation, Serdang and at Fraser's Hill, Pahang.

## Summary.

Friesian cattle have justly achieved a reputation throughout the world for their very high milk production and ability to thrive on rough fodder and bulky food.

The modern tendency in Friesian cattle breeding is to improve the fat content of the milk rather than further to increase the yield of milk. Further, many Friesian Societies work for a Friesian which is for dairy-general purposes.

An account is given of the use of Friesian cattle in the tropics. It is shewn that while this breed generally adapts itself to tropical conditions—at least as well as most European pure-bred cattle—the chief value of the Friesian breed in the tropics is in the up-grading of native dairy cattle. The maintenance of herds of pure Friesian in the tropics is usually confined to hill stations, where the climate more closely approximates to that of the temperate zone; while Friesian crossed with native breeds usually prove eminently suitable to the tropical lowlands.

The success attending the introduction of Friesian cattle into many tropical countries accounts for the decision to establish this breed at the Government Stock Farm in Malaya.

The illustrations of Friesian cattle are reproduced from photographs kindly supplied by the Director of Agriculture, Industry and Commerce, Buitenzorg, Java.

# AN ATTEMPT TO CONTROL PADI BORERS

BY

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The insects which attack padi are numerous, but it is believed that the most important for certain areas are moths whose larvae bore inside the stems of the padi plant. The depredations of these insects have been the subject of investigations by the writers in Selangor, Perak, Province Wellesley and Penang Island, and it would appear that the damage caused by them is a limiting factor in padi cultivation.

These insects, known as stem borers, may be considered for general purposes to be of three species, but there are others of similar habits and presumably subject to the same means of control which are less common, and which have not yet been identified.

The three insects, control of which forms the subject of this article, are as follows:—*Diatraea auricilia* Dudg., *Schoenobins incertellus* Walk., and *Sesamia inferens* Walk., and it will be as well before proceeding to describe the control measures, to give a brief description of each, and an outline of their habits, for on this last the control measure discussed is based.

*Diatraea auricilia* Dudg. The male of this moth is a small insect with ochreous brown forewings having a raised spot of silvery scales in the middle and a row of silvery dots along the outer margin. The whole of the forewing is powdered and streaked with darker brown. The hindwings are brownish white. The female is a larger and paler insect and has the silver spots less prominent.

Expanse. Male 18 mm. female 25-27 mm.

The eggs, which are laid on the leaves of the padi plant, are glistening white when just deposited, but turn black just before hatching. Hatching occurs in about four days, and the young caterpillars usually bore into the stem at a node, frequently ringing the plant at this point, so that it snaps off. After three or four weeks the caterpillar pupates, usually inside the stem, but sometimes among the leaf-sheaths at the base of the plant, and in about ten days the moth emerges.

*Schoenobins incertellus* Walk. Both sexes of this moth are pale ochreous, rather darker round the outer margin of the forewing and having a black discal spot on each of these wings. The hindwings are whitish.

Expanse male 18-22 mm. Female 32-34 mm.

The habits are very similar to those of *Diatraea*, but the egg masses are covered with a felting of scales from the body of the female. The caterpillar too, is very different in appearance.

Pupation always takes place inside the stem and the pupa is enclosed in a cocoon of white silk, which has a silken tube running from it to a previously prepared exit hole. The whole life cycle lasts 4—5 weeks.

*Sesamia inferens* Walk. Forewings pale fawn coloured with a few scattered black dots near the middle. A dark brown stripe runs from the base of the wing almost to the outer margin, forking near the middle of the wing. The hindwings are white and the abdomen whitish also.

Expanse. Male 20-25 mm. Female 25-31 mm.

This insect has a different egg laying habit from either of the foregoing. The eggs are inserted between the leaf-sheath and stem of the padi plant and are thus protected from possible enemies. The caterpillar is very similar in habits, living an active life for about six weeks, then pupating, usually outside the stem, but sometimes within it. In 9—12 days after pupation the moth emerges.

As just mentioned, the eggs are protected by the leaf-sheath, thus parasites cannot readily gain access to them. The caterpillar is also protected, but in spite of this it is subject to attack by a small parasite *Apanteles* sp. and the pupa is attacked by a small insect belonging to the superfamily Chalcidoidea. Over sixty of the latter have been bred from a single pupa. It is not yet known how either of these parasites attacks the host.

It would appear, however, that *Sesamia* is of very local distribution, and is not of great importance in Krian, but is particularly numerous in Penang and Province Wellesley. This may be connected with its alternative host plants, namely sugar cane and maize.

*Sesamia* is primarily a sugar cane borer, and a large amount of cane was originally grown in Province Wellesley and this land was turned directly into rice land.

The only place where *Sesamia* occurs in Krian has a similar history, but places where rubber replaced the sugar cane, and padi was subsequently planted near the rubber, are free from this insect, there being no plant in which it could live when the rubber was planted.

Should subsequent investigations shew that *Sesamia* is a regular pest in certain areas, other control measures will have to be elaborated.

The points of difference and similarity between the three species may be tabulated as under:—

| | *Diatraea.* | *Schoenobins.* | *Sesamia.* |
|---|---|---|---|
| Egg. | Exposed on leaves (4—7 days). | Exposed on leaves (5—7 days). | Protected under leaf-sheath (4—5 days). |
| Larva. | Bores inside stem. | Bores inside stem. | Bores inside stem. |
| Pupa. | Usually protected inside stem. | In Cocoon inside stem. | Usually exposed. |

It may be seen from the foregoing table that the only stage in which *Diatraea* and *Schoenobins* are exposed and susceptible to control, other than uprooting the plant, is the egg stage, while *Sesamia* is exposed in the pupal stage only, and even the pupa is occasionally protected within the stem.

The fact that these insects are protected during the major part of their lives has rendered control a somewhat difficult matter, and the possibility of control by natural enemies was therefore considered.

Before proceeding to this, a brief mention of control measures against stem borers of padi in other countries may be made.

In Java it is found that flooding is an effective control for the white stem borer *Scirpophaga auriflua Z.* and a rotation of crops is also practised.

The species of stem borer found in Malaya are not affected by flooding however, and it is quite usual to find the caterpillars living in parts of the stem well below water level.

Rotation of crops with padi is not practiced in Malaya.

In Japan, attempts have been made to breed parasites(1), light traps are used and are said to be effective and extensive flooding experiments have been carried out, but the writers do not know what results have been obtained.

With regard to light traps, in Krian it was found that the moths were not usually strongly attracted to light, and when collecting at night, it was found necessary to walk about with the lantern and catch the moths as they were disturbed.

Probably more moths are attracted to light during the harvest, when the stalks are cut and there are no suitable egg laying sites.

At such a time, the moths, in their search for suitable sites might come within the sphere of attraction of a light trap. There is no doubt, however, that the moths are occasionally attracted to light in large numbers, even at a good distance from the padi fields. The cause of this is not yet known. It may be as stated above, and only occurs at harvest time, but it may also be influenced by the stage of the moon.

Observations have not yet been sufficiently extended, but this year a moderate number of moths was observed at light in houses at the end of February and in early March, but not in sufficient numbers to suggest a flight.

On the 31st March and the 1st and 2nd of April, however, there was a distinct flight of the moths *Diatraea* and *Schoenobius*, the insects coming in thousands on the 1st April, but in lesser numbers on the other nights. This was just after the new moon, but also during harvesting, so the cause is obscure.

It is possible that small flights occur regularly at about the time of the new moon, other conditions being suitable, and that the extensive cutting of padi at the same time caused this swarm.

At present, the action of light traps is too uncertain to warrant their use as a regular control measure, but it may be possible later to use them at certain periods with good results.

## Control by Natural Enemies.

The principle involved is either the selection of a parasite or predator which is already present in the country, and the breeding of these insects in vast numbers and their subsequent release in areas attacked by the pest, or the introduction of a parasite known to attack the insect, or an allied insect, in some other country.

The most important natural enemies of *Diatraea* and *Schoenobius* in Malaya appear to be minute insects which attack the egg, while in the case of *Sesamia* a related parasite attacking either the adult larva or pupa appears to be most numerous.

The parasites attacking the eggs of *Diatraea* are three in number, while four species attack *Schoenobius* eggs.

As it was necessary to fight both these insects it was naturally desirable to find a single parasite capable of attacking either species, rather than two species of parasite which might require different technique in rearing. Two of the parasites found satisfied this condition and it was therefore a matter of choosing between them.

The two parasites in question are—

1. *Trichogramma nanum.* Zehut.
2. *Phanurus beneficiens* Zehut.

The most suitable for experiment appeared to be *Trichogramma nanum*, for not only was it easier to handle, but as described later, it was capable of breeding in a suitable laboratory host other than its natural ones.

This parasite is a minute insect varying in length between 0.68 mm. and 0.54 mm.

In colour it is greenish black, with a tinge of yellow. The antennae are ochreous, those of the male being much longer than those of the female, and furnished with long hairs. The eyes are red.

From previous work in America, in which large numbers of a closely related species, possibly only a geographical race of *Trichogramma nanum*, namely *T. minutum* Riley, have been bred both for control of the Codlin Moth in Walnuts in California (2) and of sugar borers (*Diatraea saccharalis* Fab.) in Louisiana (3), it was decided to try the same laboratory host as is used in that country.

This insect, the Angoumois Grain Moth *Sitotroga cerealella* Oliv., is of world-wide distribution, and has the following points in its favour.

1. It is easily handled under laboratory conditions
2. It has a high reproductive capacity
3. Its eggs are easily handled

4. **Egg laying can be artificially stimulated under suitable conditions for collection of clean eggs.**

*Sitotroga cerealella* normally deposits its eggs loose in stored grain, and it was found in America (2) that it would readily lay eggs if a number of moths were placed in a small cage with a wire gauze bottom of 20 meshes to the inch. The feel of the gauze possibly approximates to that of closely packed grain, and thus stimulates the moths to lay. The eggs drop through the gauze into a shallow glass dish whence they may be readily collected. Positive results were obtained with these eggs as a host for *T. nanum*, and breeding operations on a moderate scale were commenced by the writers in July 1929.

The technique followed is essentially that devised by Flanders in California (2) but glass tubes are used as parasitising chambers instead of petri dishes, and the adhesive used for carding is a solution of chromed gum tragacanth, this being somewhat easier to handle than shellac.

The eggs are collected every morning and cleaned of scales and broken legs which may be mixed with them. They are then sifted over gummed cards, which are cut to such a size that each card holds 10,000 eggs. When dry, the cards are placed in a glass tube into the open end of which a smaller tube containing about 2000 parasites is inserted.

These tubes are now inserted into a hole in a wooden box, so that the tube containing the eggs is in the light, that containing the parasites in the dark. The parasites are attracted by the light where they find the eggs and immediately start to "sting" them and lay their own eggs inside them.

A powerful flood light is turned on at night and this keeps the parasites working so that the maximum parasitisation is obtained.

Each host egg produces one parasite and about 90% of the eggs are parasitised in this way.

## Description of Apparatus.

*Sitotroga cerealella* is bred in wooden cages, in one half of which zinc trays are arranged, one above the other. These trays contain a mixture of bran and low grade rice, into which larvae of *Sitotroga*, in preference to eggs, are placed.

About six weeks from the date on which the eggs are laid, the moths emerge from the trays and pass over to the other half of the cage which is kept dark, since *Sitotroga* prefers dark situations.

In the early stages of the experiment, when the output of moths was comparatively small, they were collected by hand into tubes and then released into cages for egg laying.

Recently, however, since the number of moths increased rapidly, it was decided to adopt the method used in America for collecting them from the cages. This method comprises the use of a vacuum cleaner, with certain modifications.

The vacuum cleaner used is the ordinary household model, with the usual accessories.

Additional apparatus comprises a length of rubber piping about 2 inches in diameter, a glass cylinder of the type frequently used for rearing insects, a tin cone, a metal cylinder with a perforated zinc lining, and a wire gauze tray to place underneath the glass cylinder.

The metal cylinder has an opening at the top to which the collecting tube is fixed and an opening at the side to which connection is made by means of the rubber piping, to the vacuum cleaner.

In order to regulate the draught of air passing through, a baffle plate is fixed on the gauze lining immediately opposite the hole in that side of the metal cylinder to which the machine is connected.

When all the necessary connections are made, the machine is set in motion and the moths are sucked up from the breeding cages.

When they reach the metal cylinder they are prevented from being drawn into the machine by the perforated zinc lining. They then fall through the hole in the tin cone into the glass cylinder.

When two or three hundred moths have been collected, the glass cylinder is removed and a fresh one is placed in position.

Since the installation of this mechanical collecting device, the time taken by the staff in removing the moths from the breeding cages has been reduced by more than half.

## Despatch and Release of Parasites.

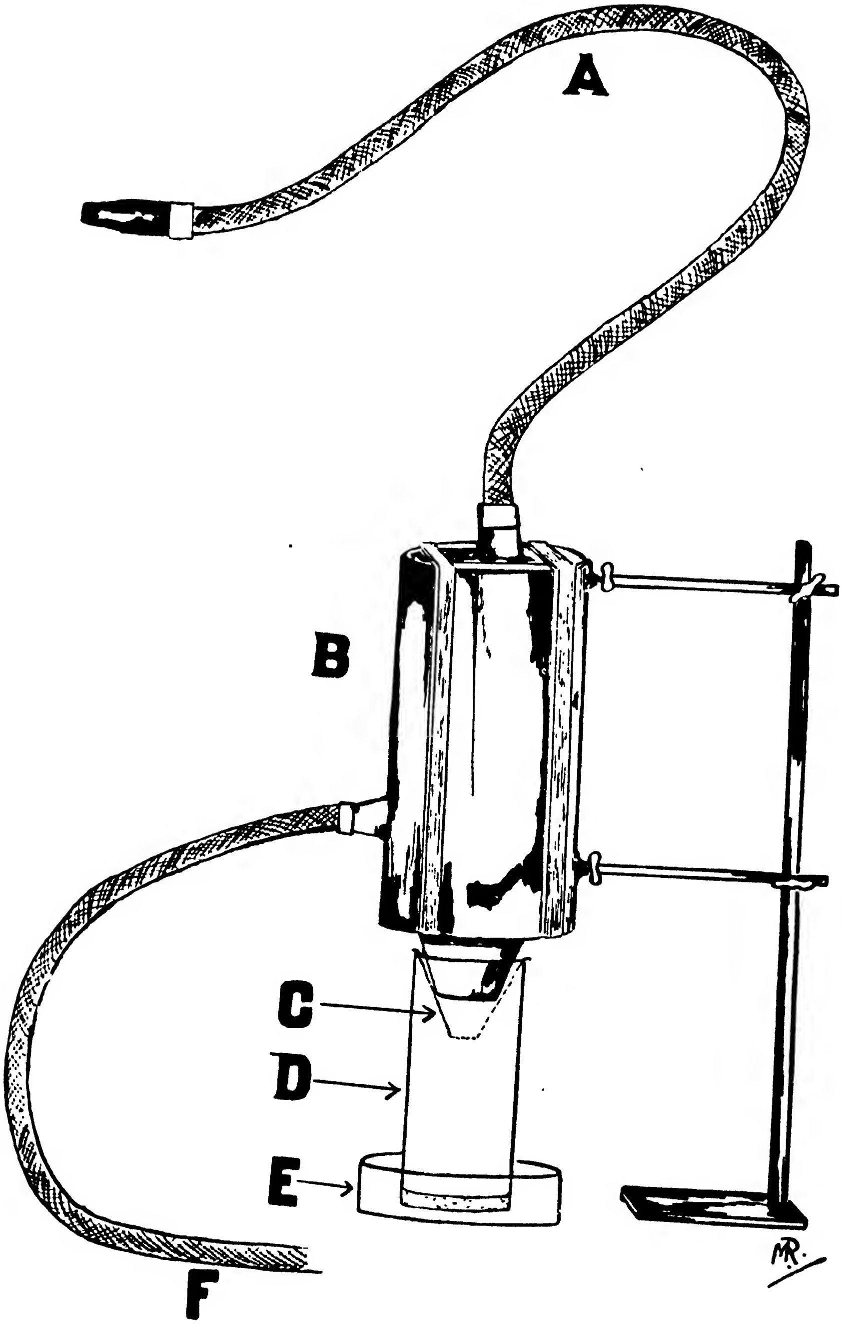
From the 1st January, 1930 up to the 30th June an average of 25,735 parasites were daily sent by rail to the Krian district for subsequent release.

The method of releasing the adult *Trichogramma nanum* in the rice field is as follows:

The egg cards are threaded on a piece of wire about six inches long and kept in place by bending up the end of the wire. The other end of the wire is twisted round near the top of some of the stalks of a hill of padi and arranged so that the card hangs free from the padi plant.

This method is based on that of Hinds and Spencer (3) for the liberation of *T. minutum* in sugar cane plantations in Louisiana. In the case of sugar cane, the egg card being free from the plant is protected from predatory insects to some extent, but it is doubtful whether this is necessary in the case of padi which grows so closely that a slight wind causes the egg card to come into contact with adjacent plants.

In the course of about three hours the majority of the parasites have left the egg card and dispersed. Examination of the egg card with a lens at this time shews that most of the remaining parasites are males and that there are a few unhatched eggs remaining. This corresponds to the observations of Hinds and Spencer for *T. minutum*.



Apparatus for Collection of Moths Bred in the Laboratory.

The cards are distributed at 10 to 20 yard intervals and if there is a wind blowing the cards are arranged in a line at right angles to the wind, and on the windward side of the area to be colonised, the parasites being distributed into the rice field by the wind.

When there is no wind, parasites are liberated at the four corners of a twenty yard square situated in the middle of the area.

This year, parasites have been liberated in Government controlled plots only, and although infestation by stem borers was undoubtedly checked at the beginning of the experiments, the invasion by stem borers from surrounding areas was high near the approach of harvest. Nevertheless, the parasites would appear to have checked the stem borers at a critical period, namely the growing period and the early stages of flowering and ripening, and it is anticipated that the yields from the colonised areas will be considerably better than from those areas to windward and on either side of the area colonised.

To leeward the effect of the parasites will probably be felt to a decreasing extent, the further away from the centre of liberation.

Yields from the various localities are not yet to hand but it is anticipated that they will confirm this opinion.

It is worthy of note that the padi areas to the windward of the main experiment shewed a very much heavier infestation by stem borers than did the colonised area and those to leeward of this area.

## Conclusion.

It would be premature, at the present juncture, to express a definite opinion as to the likely results which should be the outcome of this experiment.

Without desiring to be unduly optimistic, however, the writers anticipate that a fair measure of success, at least, will be met with.

## References.


1. On Some Injurious Insects of the Sugar Cane in Formosa. S. Matsumura.
2. Mass Production of *Trichogramma*. Stanley E. Flander (in litt.)
3. Utilization of *Trichogramma minutum* for Control of the Sugar Cane Borer. Journ. Econ. Ent. Vol. 21, 1928. W. E. Hinds and Herbert Spencer.


## Explanation of Plate.

A. Tube through which moths are drawn into the cylinder B.
B. Metal cylinder with perforated zinc lining.
C. Metal cone.
D. Glass dish into which eggs fall from egg-laying cage.
F. Tube connected to vacuum cleaner.

# CHINESE HATCHERIES

BY

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In the coastal portion of Krian District, Perak, there are several poultry farms owned by Chinese at which a fairly large number of ducks and fowls are reared for sale both in the local markets and in Penang. At these farms, eggs are hatched in special hatcheries providing a somewhat unusual and interesting method of incubation. This method gives a very satisfactory percentage hatch, though the actual percentage of chickens reared is not so good, owing to faults in the treatment of the young birds during the first few days after their emergence from the eggs.

A description of these hatcheries is given below and suggestions are made for improving the treatment of the very young chickens.

The hatchery visited consisted of two "batteries" of 6—8 hatching baskets one along either side of the front room of an attap house, while down the centre of the room was a two-tier stand where the eggs are placed the day before they are due to hatch out.

The batteries, as mentioned above, consist of 6—8 or more baskets depending on the length of the room and of course on the business done. The more business the more baskets employed.

The baskets are made after the style of a fruit basket 2 feet to 2 feet 6 inches in diameter and about 3 feet in depth. They are constructed of split bamboo or rotan. The baskets are placed in a wooden frame and are spaced about 12"—18" apart. They are insulated all round with dry padi husk, or in other words, the intervening space in the frame is filled with dry padi husk. The sides and bottom of the basket are lined with movable cardboard. The egg capacity of the ordinary basket in use is 1,000 eggs. A square piece of burlap, a little larger than the bottom of the basket, is placed in the basket and a layer of eggs placed on top, the date of first placing the eggs in the basket being marked on the eggs. Another piece of burlap is placed on top of the first layer of eggs and then a second layer of eggs is put down and so on until the basket is full. A guni bag is usually employed for the top covering.

All eggs used in the hatcheries are freshly laid and before being placed in the hatching basket are exposed to the sun for one hour or so.

Eggs are "candled" by cutting a round hole in the guni bag which covers the window and holding up the egg to the day-light coming through the hole. The rapidity and accuracy with which the eggs are candled is astonishing.

When eggs are about due to hatch they are removed one day, or in some cases two days, before from the basket and placed on a two-tier stand in the centre of the room where they remain until the chicken or duckling emerges.

This two-tiered stand has its shelves made of closely woven rotan. Over the rotan is placed guni sacking, or mengkuang-matting, then the eggs, and on top of the eggs a blanket in which are cut holes through which the chicks or ducklings emerge. After emerging, the chicks or ducklings are removed and placed outside the house in an open rotan chick basket.

The percentage hatch is usually high and while 70% is a good figure to attain at home, I believe results in the hatcheries are even higher.

Hatching 70% and rearing 70% are two different propositions and it is in this respect that a weakness exists in the Chinese hatchery.

It has already been stated that as the chickens hatch out they are removed after their down has dried and placed in a round rotan basket outside the house. One day, two day and three day chicks are often mixed together in the same basket and all huddle together for heat with the result that the weak are trampled on and there are many deaths, the mortality in 1—3 days old chicks being 15—20%.

During the first week of a chick's life, the temperature it is exposed to in a brooder is usually 90°F. Were this temperature maintained at these hatcheries, the mortality would be greatly reduced. It would be quite a simple matter to improvise a wooden box and adapt it as a brooder and use an ordinary hurricane lamp for the source of heat.

# THE WORLD'S COCONUT CROP*

BY

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Some useful information may be obtained from the statistics of nut, copra and oil exports from the nut-producing countries of the world recently prepared in the Imperial Institute, London.

In the final summary of these statistics, coconut products exported are all reduced to one common denomination namely, nuts, and to achieve this, the following nut equivalents have been employed:—

| | | |
|---|---|---|
| 1 ton of copra | = | 5,000 nuts. |
| 1 ton of oil | = | 8,125 nuts. |
| 1 ton of nuts | = | 1,400 nuts. |

It must, of course, be understood that these equivalents are not true for all localities because of regional differences in wet meat weight per nut, in oil content per nut, and in whole fruit weight. For Malaya, the figures should be about 10% less than those shown above. This purely incidental observation does not detract from the value of the comparisons which may be made by a study of the abbreviated Table of Exports which has been prepared from the statistics of the Imperial Institute.

In this Table, only coconut products (exclusive of soap and glycerine) expressed as nut equivalents and actually exported are shown. Because one-third of the copra trade of Malaya is in copra imported into Penang and Singapore from surrounding islands for conversion into copra locally or for re-export, in this and in similar cases due correction has been made, and only the true exports shown. In one case, where the figures for 1928 are not available, an estimated figure, obtained from the figures for the previous three years is given instead.

The pre-eminence of the Philippine Islands and the Netherland East Indies as nut-producing and copra-producing countries is very marked. Between them they produce about two-thirds of the world's nuts and over one half of the world's total annual production of copra which is in the neighbourhood of 100,000 tons of copra equivalent to 5,000,000 nuts. In copra production for export, Malaya comes fifth, with Ceylon a close sixth, though if consideration is allowed for the copra converted into oil in Ceylon then that colony becomes the senior copra producing country of the two.

* The following is an analysis of Statistics prepared by the Imperial Institute, London.

In the export of whole nuts, Malaya comes a good third. The collection of nuts for this purpose is confined to a few small districts, the bulk being mainly exported through Penang to Burma. Such nuts, whether for home use or for export are preferred underripe and for this reason, where nuts are picked both for conversion into copra and for human consumption, the quality of the copra is apt to suffer, as the very underripe all-green nuts which are preferred for eating yield only about half the weight of copra which may be obtained from fully ripe brown nuts, and the oil percentage of the copra obtained is much lower.

It will be seen that among the nut-producing regions of the world, the Philippine Islands take the lead for oil production, because nearly half the annual crop is converted into coconut oil on the spot. Ceylon comes next by crushing 38% of its annual crop. About one half of the oil so produced is imported to Great Britain and India takes a large proportion of the remainder for cooking and for domestic use. The Netherlands East Indies follows next in order and although only 10% of the annual crop is turned directly into oil, the aggregate so converted is almost equal to that for Ceylon. Malaya, on the other hand, is a bad fourth and although of the nuts produced locally, 10% are converted to oil, the aggregate is very small. When consideration is allowed for the total nut equivalents imported and also for these consumed locally, the oil production drops to 5% of all the nuts handled.

In Malaya, oil mills are to be found at Penang, Singapore, Klang and Kuala Selangor, but very little of the oil produced is for export to Europe or to the U.S.A., but is consumed mainly in Malaya and in the surrounding countries in the form of cooking oil and soap, and for other domestic purposes.

The explanation for the continued pre-eminence of the Philippine Islands in oil production may be due to the fact that they have satisfactory markets for cattle cake in the U.S.A. and Eastern Siberia or else to the absence of import duties and the preferential tariff for the entry of the oil into the U.S.A. This industry was first established on a large scale, on account of high prices ruling during the war. The exports of oil and copra from the Philippines are now nearly three times what they were in 1917 and it would appear that the stimulus of war prices resulted in a considerable extension of the planted areas which have since come into bearing.

The total consumption of nuts in all forms in Malaya is high, and may be estimated at 50 nuts equivalents per annum per head of the population of 4,000,000 people. This brings the total consumed locally to the not inconsiderable total of 200,000,000 nuts equivalents, or 25% of the annual crop. While this does not appear in the Table of Exports, the exports of nuts and oil for native consumption to the surrounding islands is, of course, included in the figures shown.

If allowances is made for local consumption of nuts in coconut growing countries at an overall average of 10% of the crop, the world's annual yield of coconuts may be estimated as being in the neighbourhood of 8,000,000,000 nuts.

## The World's Annual Coconut Crop—1928.

Table to show in what form nuts are exported, and the total number of nut-equivalents exported from each of the principal coconut producing regions of the world.

MILLIONS OF NUTS EXPORTED.

| Locality | | As Nuts. | As Copra. | As Oil. | Totals Exported. |
|---|---|---|---|---|---|
| *Dutch East Indies* | ... | N | 2,191 | 255 | 2,446 |
| *Philippines* | ... | N | 1,154 | 1,137 | 2,291 |
| *Oceania*: Fiji | ... | N | 342 | N | |
| New Guinea | ... | N | 230 | N | |
| Solomons | ... | N | 78 | N | |
| Tongan Isles | ... | N | 110 | N | |
| West Samoa | ... | N | 60 | N | |
| New Hebrides | ... | N | 51 | N | |
| Papua | ... | N | 48 | N | |
| Gilbert Isles | ... | N | 13 | N | |
| | | — | 932 | — | 932 |
| *India & Ceylon:* | | | | | |
| Ceylon | ... | 18 | 494 | 317 | |
| Malabar, etc. | ... | N | ½ | 2½ | |
| | ... | 18 | 494 | 320 | 832 |
| *British Malaya* | | | | | |
| Federated Malay States | ... | N | 342 | N | |
| Unfederated Malay States | ... | N | 190† | N | |
| Straits Settlements | ... | 9 | N‡ | 60 | |
| Sarawak | ... | N | 10 | N | |
| North Borneo | ... | N | 16 | N | |
| | | 9† | 558 | 60 | 627 |
| *West Indies, Etc.* | | | | | |
| Trinidad | ... | 7 | 48 | 2 | |
| Jamaica | ... | 31 | 17 | N | |
| British Guiana | ... | N | 17 | 1 | |
| Remainder | ... | N | 6 | N | |
| | | 38 | 88 | 3 | 129 |

| | | | | |
|---|---|---|---|---|
| *East Africa.* | | | | |
| Zanzibar ... | ½ | 47‡ | ½ | |
| Tanganyika ... | N | 47 | N | |
| Mauritius . | N | 7 | N | |
| Kenya & Uganda ... | N | 7 | N | |
| | ½† | 108 | ½ | 109 |
| *West Africa.* | | | | |
| Nigeria ... | N | ½ | N | |
| Sierra Leone ... | N | N | N | |
| Gold Coast ... | N | 7 | N | |
| | — | 8 | — | 8 |
| GRAND TOTALS ... | 65 | 5,533 | 1,176 | 7,374 |
| | | Million nut-Equivalents. | | |

N = Nil or negligible.
† = Approximate estimate.
‡ = Corrected for imports.

# MALAYAN OIL PALM INDUSTRY IN 1929

BY

D. H. GRIST,

*Agricultural Economist.*

The statistics relating to the progress of the oil palm industry in Malaya are revised annually by the Department of Agriculture so that it is possible to view the growth of the industry since its inception. Reference to the table of the annual plantings of this crop shews that although experimental areas were planted in 1913 and onwards, the first planting of the crop on a commercial scale was on one estate in Selangor which commenced planting in 1917. In 1920 another estate in Selangor planted a small area. In the following year these two estates planted considerable areas and a third estate in Selangor commenced planting. The total number of oil palm estates which existed in subsequent years is as follows:—1922—three; 1923—six; 1924—nine; 1925—twelve; 1926—nineteen; 1927—twenty-one; 1928—twenty-three; 1929—twenty-seven. These estates are distributed as follows:—Selangor, fifteen estates; Perak, four estates; Negri Sembilan, two estates; Pahang, one estate; Johore, five estates Only estates that have over 100 acres planted at the present time are included in the above figures.

One estate has practically 5,000 acres planted, nine estates have between 1,000 and 3,000 acres planted; eight estates have between 500-1,000 acres planted, while there are nine estates of less than 500 acres planted. As detailed in Table I, the total area planted with oil palm at the end of 1929 was 31,709 acres, distributed as follows:—Selangor, 12,674 acres; Perak, 8,296 acres; Negri Sembilan, 902 acres; Pahang, 686 acres; Johore 9,111 acres; Kedah 20 acres.

Reserve land held by the above estates is as follows:—Selangor estates 3,718 acres; Perak estates 8,068 acres; Negri Sembilan estates 1,418 acres; Pahang estates 1,817 acres; Johore estates 760 acres: a total of 15,781 acres.

Land alienated in 1929 for the cultivation of oil palms amounted to 39,060 acres distributed as follows:—Selangor 9,303 acres, Negri Sembilan 557 acres, Johore 29,200 acres.

If the land in Malaya already alienated for oil palm cultivation be planted up, the total area under cultivation will be approximately 120,000 acres.

The following areas have been ear-marked by Government for the cultivation of oil palms, but have not yet been alienated: Kuantan, Pahang 13,800 acres; Dindings, Straits Settlements 7,000 acres; Tampin, Negri Sembilan 9,000 acres. These figures should, however, be accepted with caution, as in

TABLE I.

**Annual Planting (in acres) of Oil Palm in Malaya.**

| State. | Year. | | | | | | | | | | | | | | | Total Acres. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1913 | 1914 | 1917 | 1918 | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | |
| Selangor - | 12 | 2 | 100 | 253 | 270 | 470 | 821 | 394 | 1877 | 1848 | 1309 | 1911 | 2026 | 476 | 905 | 12674 |
| Perak - | ... | ... | ... | ... | ... | ... | ... | ... | ... | 220 | ... | 478 | 1818 | 2763 | 3017 | 8296 |
| Negri Sembilan - | ... | ... | ... | ... | ... | ... | ... | ... | ... | .. | ... | 100 | 500 | ... | 302 | 902 |
| Pahang - | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 592 | 94 | 686 |
| Johore - | ... | ... | ... | ... | ... | ... | ... | 30 | ... | 10 | 962 | 1289 | 2831 | 1005 | 2984 | 9111 |
| Kedah - | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 20 | 20 |
| Total planted annually - | 12 | 2 | 100 | 253 | 270 | 470 | 821 | 424 | 1877 | 2078 | 2271 | 3778 | 7175 | 4836 | 7322 | ... |
| Total planted to date - | 12 | 14 | 114 | 367 | 637 | 1107 | 1928 | 2352 | 4229 | 6307 | 8578 | 12356 | 19531 | 24367 | 31689 | 31689 |

most cases it is not known what proportion of these areas are suitable for the cultivation of oil palms.

At the end of 1929, eight estates were equipped with factories for the preparation of palm oil of high quality, and for the extraction of the kernels. In every case the centrifuge system of oil extraction was adopted. In addition, five factories are in course of erection and will commence working during the year 1930.

The annual net exports of palm oil and palm kernels, abstracted from the monthly Return of Foreign Imports and Exports are shewn in Table II. These returns, however, do not give a true figure of the production of these commodities as there is now a small import of palm oil for re-export, and an import of seed at high prices for planting purposes. The annual production of palm products, compiled from returns supplied by all estates in the country, is stated in Table III, which is complete from the year of the first production in Malaya.

The estimate of production in 1930—based on returns from estates—is as follows:—Palm oil 3,100 tons; palm kernels 620 tons.

TABLE II.

**Annual Net Exports of Palm Products from Malaya.**

| Year | Palm Oil | | Palm Kernels | | Total Value Palm Products $ |
|---|---|---|---|---|---|
| | Tons | Value $ | Tons | Value $ | |
| 1926 | 726 | 254,165 | 180 | 36,708 | 290,873 |
| 1927 | 852 | 269,966 | 178 | 31,763 | 301,729 |
| 1928 | 1,460 | 384,954 | 261 | 43,475 | 428,429 |
| 1929 | 1,831 | 499,308 | 266 | 38,503 | 537,811 |

TABLE III.

**Annual Production of Palm Oil and Kernel in Malaya.**

| Year | Palm Oil | Palm Kernels |
|---|---|---|
| | Tons | Tons |
| 1923 | 195 | 50 |
| 1924 | 286 | 81 |
| 1925 | 536 | 110 |
| 1926 | 716 | 168 |
| 1927 | 915 | 185 |
| 1928 | 1,345 | 286 |
| 1929 | 1,819 | 311 |

# Abstracts.

## THE TRANSPORT OF FRESH FRUIT BY SEA.

In a recent number of *The Malayan Agricultural Journal*, attention was drawn to a report on trial shipments of pineapples from Zanzibar to England. The transport of fresh fruit by sea from the tropics to the temperate zone presents many difficulties, not the least being the seasonal variations in climate and the variations in temperature during the voyage.

The successful solution of the problems, however, opens up promising markets. The interest of Malaya in this subject naturally centres in the pineapple industry, but there are other fruits which would doubtless find a ready sale in the United Kingdom, if the transport problems could be overcome. The mangosteen, chiku and the insufficiently known duku, in addition to the pineapple, suggest themselves as suitable for this market. It is probable that the durian, although popular locally, would be less appreciated in Europe.

Two publications* in Dutch, entitled "Some particulars of Refrigeration of Trial Shipments of Dutch East Indian Fruit", and "Fresh Pineapples from Surinam", both by Ir. W. Spoon, give interesting information on this subject. A review in the Kew Bulletin† on trial shipments of mangosteens, inaugurated at the instigation of the Commercial Museum of the Colonial Institute at Amsterdam, in co-operation with the Department of Agriculture (and probably also the work of Ir. W. Spoon) is also pertinent. The following notes are abstracts from the two first mentioned publications.

Much experience has been gained on the subject of the shipment of fresh fruits to England from Australia and South Africa. For particulars of this work, the reader is referred to the summary of results, given by F. Kidd in three lectures before the Royal Society of Arts, London, under the title of "Biology and Refrigeration".‡ It should be noted that the following descriptions refer to the small refrigeration rooms, more accurately termed cells.

**Equipment.** The refrigerating cells are of a rectangular shape, are 2 to $2\frac{1}{2}$ metres high and have a wall area of about 20 square metres. Along the walls are tube radiators in which the liquid ammonia is evaporated. The cell is air-tight. When in use, the air can be renewed if necessary with cold air (cooled

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* Published by Berichten van de afdeeling Handelsmuseum van de Koninklijke Vereeniging Kolonial Institute Nos. 47, 48—1929.

† A Review by F. N. H. published in the Royal Botanic Gardens, Kew Bulletin of Miscellaneous Information, No. 2—1930.

‡ Journal of the Royal Society of Arts, Vol. 77, pages 269, 288 and 313—(1929. See especially pages 295-298 for observations on ship's refrigeration rooms for such fruit transport.

before supply). The cell is provided with an electric fan which works throughout the voyage to keep the air in movement.

**Humidity.** Humidity records with dry and wet bulb thermometers shew a figure around 93—94% for homeward voyages, and about 91% for outward voyages.

A shipment of chiku in 1929 arrived in Europe with conspicuously wrinkled skins, caused by loss of moisture during the voyage. Such evaporation is only possible when the refrigeration room is especially dry.

**Temperature.** The refrigerating rooms stocked with fruit, were kept at a temperature of $+3°C$.

## Fresh Pineapples from Surinam.

There has been considerable discussion of late regarding the possibility of exporting canned and fresh pineapples from Surinam. Promoters appear optimistic, but although, in the case of the canning industry, comparisons are made with the existing industries in Hawaii and Singapore, similar research regarding the possibilities of exporting the fresh fruit appears to have been omitted. It is necessary to consider the market for such fruit and the methods of transport to the market.

**Markets.** The market to which attention is drawn is the Netherlands. In that country, fresh pineapples are considered a luxury in comparison with other fresh southern imported fruits, such as bananas, oranges and lemons. It is stated that in 1926, the Netherlands consumed 70 tons of pineapples and 19,124 tons of bananas. The conclusion is reached that the market for fresh pineapples is small and it would be necessary for the promoters to stimulate demand for pineapples by propaganda. Other points of importance in this connection are—size of fruit and price at which it could be profitably sold.

In respect of varieties, the fruit of the various species of pineapples can be divided into two main groups. In the one group, the ripe fruit is of an even yellow colour, of moderate size, pulp rather dry but with a fine fibre. In the second group, the fruits are large, the fibre coarser, but with more juice; when ripening, colour changes unevenly. A few well-known representatives of the first group are the "Monsterrat", "Ripley Queen" and "Nanas Bogor".* Representatives in the second group are the "Smooth Cayenne" or "Cayenne Lisse" and the "Giant Kew". For the purpose of selecting the species suitable for export, consideration must be given to these differences. The exporter must decide whether it will be easier to create a demand for a small pineapple or for a more expensive large pineapple.

**Transport.** Europe's principal suppliers of fresh pineapples are the Azores and South Africa. The Azores are comparatively near, the fruit only taking about ten days on the voyage. Transport from South Africa takes about three

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* "Nanas Bogor." Javanese name for a pineapple of this type originating from Bogor (Buitenzorg).—Translator.

weeks, necessitating cold storage during the voyage. For the much shorter voyage from the Azores, which it must be remembered is situated about 38° northern latitude, storage in a well ventilated hold is sufficient. Against the advantages is the disadvantage that the fruit has to be grown under glass, whereas in South Africa it can be grown in the open, thus lowering the cost of production.

Conditions in Surinam approximate to those of South Africa necessitating refrigeration. In spite of the fact that in the middle of 1928 a successful shipment of fresh pines was sent from Surinam to Europe, it is unlikely that this system would prove satisfactory for regular shipments, owing to the great differences in climatic conditions in the course of a year.

The successful shipping of fresh pineapples in refrigerating rooms is by no means certain. The Food Investigation Board in 1927† drew attention to the unsatisfactory results of shipping South African pineapples, especially to their poor keeping qualities after being landed. The Fruit Export Control Board in Cape Town has since admitted that the pineapple is still the least satisfactory South African fruit for purposes of export.

It should not be concluded that the successful shipments of pineapple from Surinam is an impossibility, but rather that careful research should be made and advantage taken of the experience gained in other countries. The fruit must be suitably packed and the temperature of the refrigerating room carefully regulated.

In South Africa, crates for packing pineapples are 27 x 14 inches for Queen Pines and 27 x 16 inches for the Cayenne variety. Such crates contain a single layer of pineapples in fine shavings. A larger shape of crate is also used, but as this provides for a double layer of fruit, it is considered less satisfactory.

The method of packing pineapples from Java are discussed. In the main, these follow the lines of the South African experiment. The following two methods were the subjects of experiments in Java:

(a) Flat crate holding a single layer of fruit, laid top to base alternately to save space: dimensions of crate 80 x 36 x 17 centimetres. Padding: Coconut fibre.

(b) High crate holding two rows of fruit, which stand on their stiff leafy crest. Inside the crate, near the top are fixed two slats to which the stalks of the pineapple are tied. Dimensions of crate 64 x 25 x 26 centimetres. No padding.

Finally, there is the question of temperature in transit. In the trial shipment from Java it was found that a temperature of +3 to +4°C was unsuitable. Greater success is expected from a temperature of +6 to +7°C.

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† Report of the Food Investigation Board for the year 1927. Page 40—London 1928.

# Reviews.

## The Improvement of Yield in Hevea Brasiliensis

BY

F. SUMMERS, B.A., M.SC., B.SC.

*Singapore, Kelly & Walsh, Ltd., 1930, pp. 198 and List of Works Referred to. Price $5/- (Straits Currency).*

The author of this informative and attractive book has set out to summarise the work accomplished in the East Indies with the object of improving the yields of Hevea. Unquestionably he has succeeded.

The book provides a concise guide to those who are concerned with attempts to increase the production of latex from the rubber tree. The subject matter is divided into three chapters, namely, (I) Budding, (II) Seed Selection and Breeding, and (III) the Early Diagnosis of High Yielding Plants. Chapter 1 follows generally the lines of Col. Summers' previous publication, "The Budding of Hevea in Modern Plantation Practice," Planting Manual No. 2, published by the Rubber Research Institute of Malaya. Under each chapter, the facts adduced are presented in a clear manner and provide adequate information on the various aspects of the problem under consideration.

The history of the early efforts with budding in the Netherlands East Indies, Malaya and Ceylon are outlined. Of particular interest is the record of pioneer work undertaken by Major Gough at Prang Besar Estate, Kajang. With regard to the present position, Col. Summers states that there is now available a wide range of proved clones which, if the trees are grown 80 to the acre, should furnish yields of at least 500 lbs. of rubber per acre in their sixth year, 800 lbs. in their seventh year and at least 1,000 lbs. in their tenth year.

The budding method is described in detail, the essential features of which were widely demonstrated by the Department of Agriculture in 1921 and 1922. Useful instructions regarding the packing and storage of bud-wood are also given.

The chapter on seed selection and breeding is of less concern to the planter; the author makes it clear that prospects of yield improvement by methods of seed selection are still remote, whereas the budding method has not yet been developed to meet a tithe of the demands that may be made of it in the hands of the planter.

In the final chapter—Early Diagnosis of High Yielding Plants—the numerous attempts to demonstrate relationship between yield and certain

characters of the latex vessel system are referred to. Col. Summers deals to some purpose with the "Ashplant method" or "tube bore theory" which was so loudly acclaimed during the latter part of 1928.

J.N.M.

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## Principles of Tropical Agriculture

BY

H. A. TEMPANY, D.Sc., F.I.C., F.C.S.

and

G. E. MANN, M.C., M.A.

This book, which is published under the auspices of The Incorporated Society of Planters, Malaya consists of twenty chapters of 328 pages, together with a bibliography, index and 25 illustrations. The book is conveniently divided into two parts (1) Limiting factors in crop production, (2) Agricultural Practice.

As is well known, the senior author has had a long and wide experience of tropical agriculture as Director of Agriculture in the West Indies, Mauritius and more recently in Malaya and is one of the world's authorities on sugar cane cultivation; while the other author has had considerable experience in instructing Malay Students in the applications of science to the art of agriculture.

The principles of agriculture are essentially the same in temperate, sub-tropical and tropical countries, but the methods of application of these principles differ considerably in the various agricultural regions of the world owing to climatic and other factors. The second part of this book on agricultural practice, therefore, applies particularly to tropical agriculture.

Students of tropical agriculture will be especially interested in Chapter IV on the climate of the tropics, which is such an important factor in tropical agriculture, although the whole of Part I conveys a sound knowledge of the many factors which influence crop production in all countries.

The Second Part of the book, on Agricultural Practice, will enable the student to appreciate how these limiting factors may be overcome or their efforts reduced. The practical planter or farmer does not always realise the limitations imposed on the scientific agricultural adviser by the conditions on the estate or farm. Scientific advice is limited by the question of economics. Improvements can be effected on practically all cultivated areas by appropriate treatment, but the application of the methods recommended depend frequently on the cost of the method, the rate at which improvement can be effected and the value of the crop obtained as a result of the method of treatment.

Two interesting and valuable chapters in Part II are those dealing with Plant Pests and Diseases and the Economics of Crop Production in the Tropics.

Information on these important agricultural problems are frequently omitted or discussed in a few paragraphs in books of this nature.

The influence of ethnographical factors on agriculture, for example, is to be seen particularly in a densely populated country such as Java.

In no other art or industry are so many factors concerned as in the art of agriculture and in many respects the application of scientific knowledge to this industry is in its infancy.

The authors are to be congratulated on their efforts in compiling a valuable textbook, which should be in the hands of all planters. It can be recommended also for the use of agricultural educational institutions.

The book is well printed and is remarkably cheap at the price of $4.50.

B.J.E.

## Annual Report of the Rubber Research Institute of Malaya for the year 1929.

The annual report of the Rubber Research Institute of Malaya for 1929 is to hand and is a document of considerable interest.

The report divides itself into ten sections and deals with the activities of the various divisions of the institute.

It is gratifying to be able to record that the institute has now settled down to a period of steady production. The initial difficulties consequent on organisation have now been overcome and it is clear that its activities are meeting with a wide measure of appreciation from the planting public. It is to be noted in this connection that the acting Director remarks that the advisory work on behalf of estates has interfered considerably with research programmes and that this is to be regretted in some respects. On the other hand, it may be observed that an institution of this type is of little value unless close contact is maintained with the planting industry which it is intended to assist. A *reductio absurdum* would be a condition of affairs in which a research institute carried out a large volume of research work to which no attention was paid by the industry which it was intended to benefit. Consequently, although the volume of research work may to some extent be diminished by the advisory activities which the Institute has been called upon to fulfil, there is no question that in the aggregate there is a balance of gain, inasmuch as practically all research officers have been constantly brought into touch with the planting community and so cannot have failed to realise the limitations imposed by practice and to maintain a practical outlook.

It is becoming clear that the most important role of the Field Division of the Institute lies in undertaking liaison between the research worker and the planter. The definition of relation thereby afforded is all to the good.

In a cognate connection allusion may also be made to the marked advance which has been achieved in affecting liaison with other bodies engaged in similar work, particularly with the Department of Agriculture and the Department of Co-operation. A notable effort in this connection has been the organisation of a propaganda caravan to be administered jointly by the three bodies. It is also to be noted that the activities of the Institute have now been definitely correlated with the work of the Department of Agriculture and it has been agreed that for all matters concerned with the administration of disease control measures and also for propaganda among small holders, the Department of Agriculture should be responsible acting in collaboration and in close touch with the Institute.

Effective collaboration has also been rendered by the Institute to the Department of Co-operation in its scheme for the establishment of co-operative rubber factories for small holders.

It is not too much to say that the success or failure in an institution of this type depends very largely on its relationship with the planting body and cognate official institutions, so that the advances recorded in these respects must be regarded as of importance.

On the research side, work has followed the research programmes which have been laid down. Particular interest attaches to the botanical investigations which have had to do with the trying out of known clones and with the establishment of new ones, also to the work which has been carried out on the anatomical processes attending the union of scion and stock in budding as well as in relation to pollination and seed selection.

Some confusion may still exist in the minds of planters in Malaya as to the relative merits of budded material as against selected seed and the definition of the respective roles which these two operations are likely to play is consequently important. It seems clear that in future, work will tend more and more towards the development of high yielding strains by cross pollination and the propagation of these strains by budding.

In relation to soils, the performance of a considerable amount of useful work is recorded; the remarks of Dr. Haines on the role of soil analysis are very much to the point, inasmuch as there is probably no subject in the whole range of agricultural science concerning which so much misconception exists as to the value of soil analysis.

In relation to pathology, no particularly new or striking occurrence is recorded, if we except the considerable extension of secondary leaf fall which has been observed. Attention may, however, be called to the question of testing various mixtures used as fungicides in treating bark diseases. The need for some reliable guide for the testing and standardising of such products is becoming more and more apparent, especially when the rapidly growing list of proprietary and other preparations available for use in this connection is considered.

In the report of the chemical division, special attention may be called to the work done on mould developments in sheet and crepe rubber and also to the work of Dr. Rhodes in relation to latex investigations.

A special section of the report deals with the progress made at the experiment station at Sungei Buloh. Work on this area was commenced in 1928. Up to the end of 1929, 838 acres had been cleared, 571½ planted, while a further 73 acres had been lined for planting. Simultaneously, a number of buildings have been erected, plans for extensive field experiments worked out by the various divisions and a considerable planted area established under experiments. The rapid progress made in getting the station into working order reflects great credit on all concerned.

An institution such as the Rubber Research Institute cannot be expected to attain its full value until a number of years have elapsed since the date of inception.

The report, however, clearly indicates that it has now been established on sound lines and that a satisfactory programme of work has been evolved. There is no reason to doubt that, given a continuation of the existing policy, the Institute will continue to increase in efficiency and utility from year to year and fully justify the hopes that were entertained at the time the project was first formulated.

H. A. T.

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## MALAYA AT THE BRITISH INDUSTRIES FAIR 1930.

Malaya occupied a corner stand at the British Industries Fair, held at Olympia in February and March of this year. The Malayan exhibits were of a general nature though special prominence was given to oil palm products and canned pineapples.

Tins of Malayan pineapples were displayed under every obtainable label and in all standard packings. As at other exhibitions, the opinion was frequently expressed that certain brands of the Golden Quality Malayan pineapple can now compare, as regards flavour and grading, on level terms with competing countries. Correspondence indicates that fresh business has accrued to importers as a direct result of the participation of Malaya at the Exhibition.

Malayan coffee attracted some attention, but its quality drew unfavourable comment from experts, chiefly on account of the amount of broken and inferior berries.

Enquiry was received for samples of kapok seed for experimental purposes, with the object of extracting therefrom a solvent used in varnish manufacture.

Mr. H. S. Banner, Publicity Agent at the Malayan Information Agency, who was in charge of the stand, in reporting on the Malayan exhibits, adds that there was a most satisfactory enquiry from representatives of schools all over the country for the Card of "Products of Malaya" which was prepared last year for educational purposes.

## OBITUARY.

### Mr. L. C. Brown.

We regret to announce the death, at the age of 79, of Mr. L. C. Brown, at Penang on 19th June, 1930.

Mr. Brown arrived in Penang in the year 1870 and at the time of his death was the oldest European resident in the Settlement.

In 1902, Mr. Brown was appointed Inspector of Coconuts, Federated Malay States. The creation of the post was rendered necessary on account of the alarming increase in the incidence of coconut pests. For this post, Mr. Brown was well qualified by reason of his long acquaintance with Malayan agriculture, his knowledge of the Malays—their language and their country—and by his infinite tact which enabled him to rely on persuasion rather than on the laws for the performance of his duties.

The Department of Agriculture, F.M.S., was formed in 1905 and Mr. Brown's division was afterwards incorporated in the Department.

In addition to informative articles in this Journal, Mr. Brown was the author of Bulletin No. 11 of this Department, published in 1911 on "Coconut Cultivation", which was in steady demand for some years and has long since been out of print. Mr. Brown's interest in agriculture did not cease on his retirement from Government service in 1914, for in collaboration with the late Mr. Munro he published that authoritative book "Practical Guide to Coconut Planting" which needs no further introduction, for a well-thumbed copy can be found on the book-shelf of most coconut planters in this country.

The Late Mr. Lewton-Brain, some time Director of Agriculture, wrote of Mr. L. C. Brown on his retirement:—"Not only with regard to Coconuts, but in many other branches of Agriculture, Mr. Brown has acquired an immense fund of knowledge, which was of the greatest value to the Department of Agriculture and to planters generally. If ever an out-of-the-way subject came up for enquiry, Mr. Brown was always applied to and usually had valuable information to impart."

"Laurie" Brown—as he was always familiarly known to his large circle of friends—will be very much missed, especially in Penang, where he settled on his retirement.

In bidding an affectionate farewell to this pioneer of agriculture in Malaya, his old colleagues and friends in the Department of Agriculture will be joined by his friends throughout the country—and especially by coconut planters—in placing on record this appreciation of the value of Mr. L. C. Brown's work to the coconut industry of this country.

# Miscellaneous.

## ENTOMOLOGICAL NOTES.

### Second Quarter, 1930.

Specimens of the Cantharid beetle, *Epicauta ruficeps* Ill., were received from Upper Perak and Kerling, Selangor, on the 13th. and 15th. May, 1930. At the former place, they were reported eating spinach and cabbage and in the latter, vegetables. The Manager of the Estate at Kerling sent information to the effect that there were literally thousands of these beetles which devoured most of the foliage in a very short time. In replies it was suggested that the increase of *Epicauta* was generally associated with the appearance of grasshoppers (or locusts) as their larvae devoured the eggs of grasshoppers. No exceptional increase in the numbers of grasshoppers was observed at these places, but it is noteworthy that on the 17th. May, specimens of the locust, *Locusta migratoroides* Rch. and F., were received from Negri Sembilan, with a report that they were caught about 2 miles north of the Tampin—Gemas Road. This area, consisting for the most port of lalang covered slopes, was inspected on the 18th. and treated with a poison bait on the 19th. May.

Daily inspections were made during the next week when locusts were found in two other "lalang" grass areas. In the following week the original area was again treated with bait. On this occasion very few locusts were seen in the original area and in the two other reported areas locusts were widely distributed Daily inspections were made and the areas examined thoroughly during the week commencing 23rd June, in an endeavour to find other localities. In two of the original areas no locusts were observed but in another area a few locusts were discovered. A comparatively recent theory has been advanced suggesting that *Locusta migratoroides* has two phases, viz:—a solitary and a swarming (migratory) phase, with a transitory stage which may be a reversion to the solitary phase or a progression to the swarming phase. It is not known at present to which phase this locust is tending.

It is interesting to observe that the first record of the presence of *Locusta migratoroides* in Malaya was in 1911 in the neighbourhood of Port Dickson and no instance of its occurrence has been observed, solitary or otherwise, since 1919.

### Coconuts.

Enquiries concerning the black or rhinoceros beetle, (*Oryctes rhinoceros* Linn.) and the red-stripe weevil, (*Rhynchophorus schach* Oliv.) are not generally numerous, but during this quarter, information was sought as to the value of "traps" for the first named and as to the control of the second named insect.

Traps consisting of refuse or dung have been found successful as an aid to the reduction of black beetles but they should be inspected every two months otherwise they may be responsible for increasing the number of beetles. For this reason the use of traps has not been advocated to any extent in Malaya. The destruction of breeding places should be the aim in the control of this insect. It seems hardly necessary to recall that the black beetle attacks the crowns of coconut and other palms whilst its grubs live in refuse, manure heaps and similar material. Referring to the red stripe weevil, it has been demonstrated conclusively that this insect cannot lay its eggs in sound uninjured palms. (v. Bulletin No. 36). By the prevention of mechanical injury and the destruction of *Oryctes* breeding places, this insect can be controlled.

Specimens of *Aleurodicus destructor* Mask. have been received on two occasions. This insect is revealed by a mass of white waxy filaments on the undersurface of the leaflets of coconuts. At one time, this white fly was considered to be a potential pest to coconuts in Malaya, but up to the present it is only very occasionally found and then it attracts attention by its appearance rather than by its injuriousness.

Caterpillars of *Parasa lepida* Cram. have been reported causing slight injury to coconuts. They are rarely troublesome to coconuts in Malaya and are parasitised by *Apanteles parasae* Rohw.

## Coffee.

Regular weekly collections of coffee berries have been made during the last two months on an estate in order to find out if by such a procedure the percentage number of berries attacked by the beetle berry borer (*Stephanoderes hampei*) can be reduced. Two areas of coffee are cultivated on this estate and the different varieties in each area are grown in close proximity to each other. The results of these examinations are given below:—

AREA I.

| Variety. | May. Percentage infected berries. | June. Percentage infected berries. |
|---|---|---|
| **Quillou** ... | 67.81 | 62.44 |
| **Robusta** ... | 18.96 | 2.96 |
| **Canephora** ... | 32.66 | 6.02 |
| **Uganda** ... | 30.71 | 11.57 |
| **Excelsa** ... | 23.52 | 1.51 |
| **Liberian** ... | 5.17 | 0.98 |
| **Abeocuta** ... | 11.21 | 0.47 |

### AREA II.

| Variety. | May. Percentage infected berries. | June. Percentage infected berries. |
|---|---|---|
| Quillou ... | 25.72 | 2.98 |
| Robusta ... | 24.13 | 1.69 |
| Canephora ... | 15.93 | 14.08 |
| Excelsa ... | 17.77 | 0 |

These figures are decidedly interesting as a reduction in the percentages of bored berries in each variety has taken place. Quillou would appear to be the most susceptible to attack.

## Gutta-Percha.

*Stauropus lichenina* Butl. The caterpillars of this Notodontid moth have been troublesome for some time by eating the leaves of gutta percha and in some cases have been responsible for completely defoliating plants on Selborne Estate, Pahang. The attacks of these insects appear to be sporadic, occurring at considerable intervals. It might be that they increase in numbers at the beginning of the year as do some other species of insects in Malaya. The life-cycle takes about 31 days, egg stage 5 days, caterpillar stage 17 days and pupal stage 9 days. In a letter concerning this insect, information was received that the Manager successfully dealt with the eggs by spraying with a kainit solution of 8 ozs. to 1 gallon of water and a further letter stated: "We first tried the same in the given solution against young caterpillars and although no useful results can be recorded in this direction except that it affected their rapacious appetite and deterred them from feeding—an attendant result was found in that the remaining unhatched eggs appeared to be affected and after a lapse of 24 hours appeared to whiten and become lifeless.

"Further areas, where eggs were abundant on the trees, were then sprayed, also a series of check experiments with controls was commenced under bell jars and these went to confirm the field experience in that the eggs appeared to be rendered sterile as no caterpillars hatched from them and it was thought that probably plasmolytic action had taken place."

In reply, the writer asked for confirmation that unsprayed eggs hatched in a normal manner and suggested that parasites were the possible cause for their non-hatching. In a lengthy reply, the following statement was made. "The eggs which were not sprayed hatched out quite normally and good healthy broods of caterpillars resulted as contra to those on the sprayed leaves. In order to make a good trial the batches all contained clusters of several hundred eggs but not a survivor—or rather a single representative—made its appearance amongst the sprayed leaves".

The writer of these notes suggested sometime ago that calcium cyanide should be tried against the borer *Pachyteria virescens* Pasc. The Manager of Selborne Estate has recently stated that this treatment was found very efficacious.

## Padi.

The liberation of parasites in the Krian area for the control of stem borers has been reduced to 20,000 every 3 days in order to increase the number of eggs of the host, *Sitotroga*, in the laboratory in Kuala Lumpur. A record number of host eggs, 480,000, was obtained on the 26th, June, 1930.

Mr. H. T. Pagden, Assistant Entomologist, who is stationed in the Krian area investigating padi borers, reports several alternative host plants of *Diatraea auricilia* Dudg. including *Hymenachne myuros*, *Sacciolepis myosuroides*, *Setaria rubiginosa* and *Oryza latifolia*. He has found a new parasite of the eggs of *Sesamia* but is of the opinion that it is probably too large to breed in the eggs of *Sitotroga*.

In connection with this work, an extensive programme has been laid down for the next padi season. In addition to the control by the parasite, *Trichogramma nanum*, experiments have been included to confirm field observations that late-sown padi is more heavily attacked than early sown, to ascertain the influence of light in attracting the different moth borers and to obtain information as to the advisability of collecting eggs and destroying padi containing borers.

An insectary is in course of construction for the breeding of *Sitotroga* and of *Trichogramma*.

*Spodoptera mauritia* Boisd. damaged padi nurseries in Perlis during June.

## General.

Important enemies of tea have not been reported and even where this crop has been examined growing under poor conditions, no serious pest was observed.

A sulphur spray for the control of mites on dahlias and chrysanthemums and an emulsion against the lantana bug, *Orthezia insignis* Dougl., damaging roses, colias, violets and other plants were recommended.

Advice was given as to the breeding places and control of house flies on an Estate.

G.H.C.

## FROM THE DISTRICTS.

### The Weather.

Practically all over the country, except in Lower Perak District and in parts of Negri Sembilan, a period of about two weeks of wet weather with heavy rain was experienced at the beginning, middle or end of the month. There was a very heavy flood at Tanjong Malim on the night of June the 14th and floods are also reported from parts of Negri Sembilan and the Muar District of Johore.

### Remarks on Crops.

*Rubber.*—There was a further fall in the price of rubber during the month. Smoked sheets from small holdings sold for 18 to 21 cents a kati and unsmoked sheet for 16 to 18 cents. Small holders everywhere are feeling the pinch of these low prices. In Province Wellesley a number of small holders have ceased tapping and the number would have been considerably larger had not tappers begged to be retained in view of the increasing unemployment. Many holdings remained untapped in Singapore Island and tapping also ceased on holdings in Selama District of Perak. In Southern Perak some Malay owners are tapping their own holdings, while in Johore on many Chinese holdings wages have been reduced or tappers have been given a half share of the rubber. Deep tapping is common and weeding is neglected. The cultivation of padi and food crops is tending to receive more attention and in several localities Malays are evincing an interest in crops other than rubber.

Reports of the presence of secondary leaf fall disease were received from two estates in Perak, its presence being confirmed in one instance only, and also from two estates, constituting new centres for the disease, in Malacca. On the estate in Perak a nursery of seedlings was heavily infected while a bud wood multiplication nursery adjoining it showed no signs of the disease.

With the advent of wetter weather Mouldy Rot disease has again become more prevalent in nearly all centres. Many small holders now undertake the required control measures on their own initiative, but the majority are still content to do nothing until they have been served with the usual notices by Inspecting Officers of this Department.

*Padi.*—In Penang and Province Wellesley, except the Southern District, work on the preparation of the land for the coming season's crop has commenced. A start has been made much earlier than was the case last year, chiefly owing to the early rainfall and the lesson learned from the disastrous effect of the drought in December and January on last season's late planted crop. In parts of Northern Perak work has also commenced. The irrigation water

from a full reservoir was turned on in Krian early in the month. Preparation of land and planting of nurseries were in progress in Southern Perak, Selangor, Negri Sembilan and Malacca, the two former States being somewhat in advance of the more southern areas, since in them many of the nurseries were planted, whereas in the latter this operation had been carried out only in a few instances in Malacca. The wetter weather in Pahang enabled transplanting to be effected, though some of the river mukims in Pahang West have not even yet made much progress with planting operations for the new season's crop. Transplanting operations in the river mukims, even where completed, are late this year owing to the dry weather in previous months and the fate of the wet padi crop is in consequence uncertain. As a result, the planting of hill padi is being encouraged in some Districts. In these mukims a considerable quantity of maize and other food crops have been planted and alternative methods of padi cultivation are being employed. In particular, where buffaloes are available, there has been a distinct revival of the method of ploughing and broadcasting peculiar to the river area and locally known as "tenggala." In South Perak also it is expected that an increased area will be planted with hill padi.

*Coconuts.*—In Malacca the local price of coconuts is $2.50 a hundred and for copra $4.50 to $5 a picul. In Negri Sembilan the local price for nuts is from 5 to 8 cents each. Copra is only made on estates. All nuts from small holdings are sold for eating; the supply is insufficient, and is supplemented by imports of nuts from Malacca.

In Pahang West the two copra kilns in the river mukims have been closed down owing to the low price of the commodity. It has been suggested to Malays of the Temerloh District, where large supplies of nuts are available, that they might with advantage sell some of their produce to Kuala Lipis, Raub and elsewhere where nuts are scarce and prices high and supplies have often to be obtained from Selangor.

*Areca Nuts.*—Some healthy young areas of this crop are coming into bearing near Pontian Kechil on the west coast of Johore. Fresh planting is reported in the areas now being opened up at the back of the same coastal belt. In Singapore some 70 acres of well drained mangrove land have been planted with areca nut. As a sole crop the plants are growing well, but where interplanted with rubber or coconuts results are less satisfactory. The rubber appears likely to smother the young areca palms and the latter adversely affect the growth of the coconuts. Some Malays in Pahang West are also displaying an interest in this crop and in kapok.

*Coffee.*—The area planted by Chinese in Batang Padang District is being extended. Coffee is growing well, interplanted with rubber and fruit trees, on an area of 60 acres in Kuantan district, but no topping or pruning has been done. Some further enquiries for suitable land for coffee planting have been made in Johore.

*Other Crops.*—Some further enquiries regarding land for oil palm cultivation have been received in Johore. Chillies are being increasingly planted by Chinese

in parts of Western Pahang as a catch crop with rubber. The produce is exported to Singapore where it is sold for $5 to $6 a picul. Ginger is also being planted to some extent as a catch crop near Kuala Kurau. Some young areas of patchouli interplanted with pineapples were observed on the west coast of Johore.

*Pineapples.*—Heavy crops of fruit have been received by the Singapore factories, but the price still remains very low.

*Fruits.*—All over the country the crop from native fruit trees such as durian, mangosteen, rambutan, pulasan and langsat ripened or commenced to ripen during the month. In Penang, durians were plentiful and in Johore crops varied in different districts from fair to poor; elsewhere crops were light. Rambutans were selling in Penang for 60 cents to $1.20 a hundred, while in Malacca durians fetched from 15 to 20 cents each.

The Malays in Raub District of Pahang are making a genuine endeavour to improve the fruit situation. A sum of $200 has been subscribed and handed to the Agricultural Field Officer for the purchase of suitable stocks of fruit trees from the Government Experimental Plantation, Serdang.

## Notes on Demonstration Station and Padi Test Plots.

*Kuala Kangsar Demonstration Station.*—Sales were 122 ducks eggs and 19 hens eggs. Khaki Campbell ducks were hatched from eggs placed under a local hen. The Rhode Island Red hens and the ducks continue to lay fairly well, but the Light Sussex hens only produced one egg and the one remaining White Wyandotte did not lay.

*Seremban Fruit Station.*—Greater and Lesser Yams and the maize variety Salisbury White Corn were harvested. A new area of the maize was sown. On the young trees one fruit of Jaffa, 3 fruits of Mediterranean Sweet and two fruits of St. Michael oranges ripened. The fruits were of good flavour and very juicy. Thompson's Improved Navel Orange did not appear to ripen properly, though it turned yellow.

*Kuala Lipis Demonstration Station.*—The growth of the Soya bean varieties has been rather uneven, E. B. No. 3 being distinctly better than E. B. No. 4. The two varieties of maize and the ground-nuts have only made fair growth due to dry weather in the early stages. One variety of Tapioca, Java No. 7, was completely beaten down by a storm in the middle of the month. Three varieties of Sweet Potato were doing well, but the variety North No. 3 was less successful. Five varieties of banana planted in November 1929 fruited, the sixth variety, Mas, has not yet formed fruit. The grape fruit trees fruited heavily. Of eight cover crops under trial two, Calopogonium and Centrosema, have made good growth, three have made uneven growth and three have failed entirely owing to drought after planting. All the citrus trees received cultivation and pruning and the general upkeep of the Station received attention.

*Pekan Demonstration Station.*—The cleaning of the wet padi plots was continued and the dry padi plots were disc harrowed. Lining and holing for budded oranges and grape-fruit were completed. Improved varieties of maize, tapioca and sugarcane from the Government Plantation, Serdang were planted. The first crop of English vegetables was mostly lifted. Lettuce and radish were successful, but cabbages were poor.

*Pulau Gadong Padi Experiment Station, Malacca.*—Cultivation, consisting of first ploughing and harrowing, proceeded throughout the month and most of the nurseries were sown. One block of nurseries was damaged by a flood immediately after sowing and had to be partly resown. Plots for a new padi manurial scheme were marked out and the work of preparing the bunds was proceeding. This scheme will also be carried out at the Titi Serong and Talang Stations.

*Bukit Merah Padi Test Plot, Province Wellesley.*—The general layout of this new plot has been decided and the work of repairing bunds and putting drains and water-courses in order has proceeded during the month. The work of clearing the land and preparing it for planting has been commenced and nursery beds were also being prepared.

*Glugor Padi Test Plot, Penang.*—Similar work to that at Bukit Merah has been carried out on the area which is being leased from Glugor Estate. The work of repairing bunds and water courses has been completed and the first clearing of the land has been commenced.

*Talang Padi Test Plot, Kuala Kangsar.*—Plots were laid out for the new scheme of manurial experiments.

*Lenggong Padi Test Plot, Upper Perak.*—A site has been provisionally selected and recommendations submitted for planting it during the coming season.

*Kuang and Kajang Padi Test Plots, Selangor.*—The general layout has been arranged and the land prepared for planting. At Kuang, seedlings will be ready for transplanting early in the coming month.

*Jelebu Padi Test Plot.*—Preparation of the land for planting has been completed.

*Dong Padi Test Plot Raub, Pahang.*—The land was being prepared for planting. In field No. 1 where water was plentiful, the usual system of cutting the weeds and hand cultivation of the soil was followed. In field No. 2 where water was not yet available the land was ploughed and harrowed.

*Temerloh Padi Test Plot.*—Varieties Radin 13 and 7 were transplanted at the end of May. The former made good growth, but of the latter, which was planted in the deepest portion of the plot, it was found necessary to pull out about one third of the seedlings owing to flooding at about the middle of the month. Nurseries of the dwarf strain Serendah were sown on the 8th June and made good growth.

*Alor Gajah Padi Test Plot.*—The nurseries were prepared and sown with five selected strains of Nachin and 4 selected strains of Siam; local unselected Nachin and Siam padi were sown for planting in the control plots.

## Plant Distribution.

Pedigree strains of padi from various Government Experimental Stations were distributed to cultivators for trial in various parts of the country.

As a result of last season's bad crop, there was a shortage of seed in three padi areas in the Krian District; a large quantity of pedigree seed was therefore sold to cultivators at the end of the month.

Other plants distributed have included fruit trees from the Seremban Station; banana suckers from Kuala Lipis Station; and rambutan seedlings in Singapore grown from special seed obtained in Penang. Tomato seed was sent to Rompin and Pulau Manis from Pekan. In addition, small quantities of locally grown planting material were supplied to school gardens.

## School Gardens.

A large number of school gardens were inspected in various parts of the country. Frequent visits by Agricultural Field Officers and their Malay staffs are resulting in an improvement in the organisation of the gardens.

## Locusts.

The areas near Tampin on which locusts were found, together with adjacent areas, have been kept under continued observation. Flying insects occurred in very small numbers and no egg masses or hoppers were discovered.

## Rats.

In Province Wellesley rewards have been paid for 140,252 tails during the month, making a total for the first half year of 586,958 tails. Poison balls given out amounted to 18,850. As the work of cleaning up the padi fields has commenced, large numbers of poison balls have been placed in patches of undergrowth of all kinds adjoining the padi fields in the hope of clearing out rats from these badly infested patches.

In Krian, as a result of steps taken by the Agricultural Field Officer, interest in rat destruction is reviving and the tails recorded amounted to 115,733.

In Negri Sembilan land adjacent to padi fields is being cleared of weeds and undergrowth and trapping of rats has started. In Malacca also, close attention is being given to the removal of similar cover for rats and a fresh stock of traps has been purchased in readiness for the coming season. No damage to nurseries has so far been reported.

# DEPARTMENTAL NOTES.

## Major Georgi's Visit to New York.

As noted elsewhere in this number, Major Georgi visited New York to confer with jelutong manufacturers. In addition to his enquiries into the jelutong industry, Major Georgi interviewed representatives of the Department of Commerce regarding possible enquiries concerning tropical plant products from the Federated Malay States; he also visited an important steel company regarding the utilization of palm oil in the tinplating industry.

## Demonstration to Market Gardeners at the Government Experimental Plantation, Serdang.

On June 4th, thirty-nine Chinese market gardeners from around Serdang attended a demonstration at the Experimental Plantation. The visitors were mainly Keks, who are essentially pig breeders. It was not surprising therefore that the inspection of the stock farm was the most important item on the programme. They were so impressed that they decided jointly to purchase a pure bred boar for breeding purposes.

Much interest was taken in the mechanical side of tea manufacture, exhaustive enquiries being made regarding running costs and upkeep. The method of withering attracted much attention, as did the oven for firing. It is probable that similar contrivances will be erected for joint use in the area over which these people are working.

## Leave.

Mr. T. D. Marsh, Assistant Agriculturist, has been granted eight months and three days leave on full pay, with effect from 13th June, 1930, inclusive.

Mr. Marsh will represent the F.M.S. Government at the World's Poultry Congress, London, in July 1930. He will also be in attendance at the Malayan Stand at the International Exhibition, Antwerp, for one month during his leave.

Mr. A. Sharples, Mycologist, has been granted six months and thirteen days leave on full pay, with effect from 27th June, 1930.

Mr. Sharples will represent the S.S. and F.M.S. Governments at the 5th International Botanical Congress at Cambridge in August and the Conference of Fruit Production to be held in London in August. He will also attend the meeting of the Imperial Botanical Conference on 15th August at the Imperial College of Science and Technology, London.

On the termination of Mr. Sharples' leave he will be seconded to the Rubber Research Institute of Malaya as Chief of the Pathological Division.

Mr. W. N. C. Belgrave, Plant Physiologist, has assumed duties of Assistant to the Director of Agriculture in addition to the duties of his appointment, from 28th June, 1930.

# MARKET PRICES.

## June, 1930.

*Rubber.*—The price of rubber continued to decline, a new record in low prices being established. The average price in Singapore was 20.55 cents per lb. compared with an average price of 23.36 cents per lb. in May. The lowest price recorded during June was $18\frac{3}{4}$ cents per lb. while the highest price was 23 cents per lb. The average London price of rubber for the month was 6.15 pence, compared with 6.9 pence in May: the highest price quoted was $6\frac{3}{4}$ pence per lb., the lowest $5\frac{7}{8}$ pence per lb.

*Copra.*—Copra prices dropped heavily. The average prices for the month were \$7.94 per picul for F.M. quality and \$8.38 per picul for S.D. quality compared with \$8.63½ and \$9.15 per picul respectively for the previous month.

*Gambier.*—Prices further declined during the month from \$8.38 to \$8.04 per picul for Block Gambier, and from \$16.10 to \$15.31 per picul for Cube Gambier.

*Nutmegs.*—Lower prices were realised for nutmegs in June. Singapore average prices were for 110 per lb., \$28.25 per picul compared with \$29.60 in May; 80 per lb., \$35.25 per picul compared with \$36.20 per picul in May.

*Pepper.*—Singapore prices for black pepper were \$37.37½ per picul compared with \$38.20 in May: \$51.56 per picul for white pepper compared with \$51.42 in May.

*Rice.*—Singapore average prices in June: Siam \$370, Saigon, white \$261; Rangoon, white \$244—all per coyan. Corresponding prices for May were \$370; \$269; \$249.

*Sago.*—Singapore average prices for June were as follows:—Pearl, fair \$6.19, compared with \$6.37½ per picul in May; Flour, \$3.32 per picul compared with \$3.85 in May.

*Tapioca.*—Average prices for June in Singapore: Flake, Small, fair \$4.10½ per picul; Pearl, fair, \$6.19 per picul. May average prices were for Flake \$4.81, Pearl \$6.95.

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The above market prices are based on the daily cabled London quotation and the daily Singapore quotation for Rubber; on the Singapore Chamber of Commerce Market Reports covering the period of May 26th to June 21st, and on other local sources of information.

1 coyan = 40 piculs. 1 picul = $133\frac{1}{3}$ lbs.

The dollar has been fixed at 2 shillings and 4 pence.

# MALAYAN RUBBER STATISTICS.

**Stocks of Rubber including Latex and Revertex held by Dealers and Estates of 100 Acres and Over, the Declared Production of the same Estates, Import and Export Figures, and Estimated Figures of the Production of Estates of Less than 100 Acres, for the Month of May 1930, in Dry Tons.**

| Territory | Stocks at beginning of month | | | Production by estates of 100 acres and over | | Production by estates of less than 100 acres (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ports | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | during the month: Foreign | during the month: From Malay States | during the year 1930: Foreign | during the year 1930: From Malay States | during the month: Foreign | during the month: Local | during the year 1930: Foreign | during the year 1930: Local | Dealers | Estates of 100 acres and over | Ports |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **Malay States** | | | | | | | | | | | | | | | | | | |
| Federated Malay States ... ... | ... | 11,059 | 13,966 | 1,688 | 48,428 | 8,361 | 47,237 | Nil | 11 | Nil | 37 | 15,200 | 4,718 | 79,361 | 27,888 | 8,726 | 6,441 | ... |
| Johore ... ... | ... | 1,671 | 4,918 | 953 | 15,066 | 4,712 | 20,331 | Nil | 3 | Nil | 7 | 827 | 5,810 | 5,082 | 32,649 | 2,216 | 3,404 | ... |
| Kedah ... ... | ... | 356 | 2,124 | 411 | 8,055 | 1,210 | 6,483 | Nil | Nil | 2 | Nil | 678 | 2,088 | 3,577 | 12,381 | 400 | 935 | ... |
| Perlis ... ... | ... | 14 | 6 | 8 | 42 | 15 | 72 | | Nil | Nil | Nil | Nil | 23 | Nil | 126 | 10 | 10 | ... |
| Kelantan ... ... | ... | 175 | 115 | 231 | 1,391 | 374 | 2,053 | 1 | Nil | 18 | Nil | 53 | 553 | 348 | 3,181 | 180 | 110 | ... |
| Trengganu* ... | ... | ... | ... | ... | ... | ... | ... | Nil | Nil | Nil | Nil | Nil | 179 | Nil | 938 | ... | ... | ... |
| **Straits Settlements** | | | | | | | | | | | | | | | | | | |
| Malacca ... ... | ... | 2,291 | 1,831 | 186 | 5,247 | | | Nil | 1,892 | Nil | 6,995 | 3,704 | | 18,927 | | 2,161 | 1,063 | ... |
| Province Wellesley | ... | 106 | 546 | 43 | 1,968 | | | | | | | | | | | 89 | 228 | ... |
| Dindings ... ... | ... | 101 | 118 | 59 | 427 | †1,202 | 15,459 | 805 | 2,932 | 4,300 | 16,784 | 5,707 | Nil | 29,043 | Nil | 123 | 102 | ... |
| Penang ... ... | 1,964 | 5,374 | 11 | 9 | 49 | | | | | | | | | | | 5,086 | 14 | 716 |
| Singapore ... .. | 4,128 | 33,265 | 348 | 74 | 1,020 | | | 9,707 | 8,533 | 48,480 | 53,380 | 20,811 | | 105,378 | | 32,402 | 270 | 3,049 |

**Analysis of Colony and Federated Malay States Dealers' Stocks at End of Month, in Dry Tons.**

| Class of Rubber (20) | Federated Malay States (21) | Singapore (22) | Penang (23) | Province Wellesley, Dindings and Malacca (24) | Johore (25) | Gross total (26) |
|---|---|---|---|---|---|---|
| Smoked sheet ... | 6,308 | 13,463 | 3,230 | 1,363 | 875 | 25,239 |
| Crepe ... ... | 677 | 15,395 | 976 | 705 | 359 | 18,112 |
| Unsmoked sheet ... | 726 | 3,544 | 880 | 305 | 504 | 7,452 |
| Scrap and lump ... | 1,015 | | | | 478 | |
| Total all Grades ... | 8,726 | 32,402 | 5,086 | 2,373 | 2,216 | 50,803 |

*Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated April 10. The ratio of the reduction on wet rubber, taken from Dealers' returns, is 33.4% for Singapore and 26.4% for Penang.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I. & E. 5, dated May 3, reduced to dry weight by the percentages for April in Note 3; (*S.S. Gazette* Notification No. 919/1930).

6. Foreign exports are those of each State and Settlement as published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I. & E. 4, dated May 6.

*7. The State of Trengganu has no organisation at present for the collection of returns of stocks and production; the latter can be estimated as approximately equivalent to exports.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.

†9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the Columns composing it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

Kuala Lumpur,
*Singapore, June. 19, 1930.*

J. I. Miller, m.c.s.,
*Acting Registrar-General of Statistics, S.S. and F.M.S.*

# SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS, FOR THE MONTH OF MAY, 1930.

| State | Locality | Acreage of Padi Land | Acreage planted current season | Stage of Cultivation | Prospects of Crop | Estimated crop Harvested | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | | | |
| **Perak (North)** | Krian Dist. | 53,250 | 49,770 | Harvesting completed | | 10,845,380 gts. | Average yield 230 gtgs. per acre |
| | Larut ,, | 8,525 | 8,275 | ,, | | — | ,, ,, 120 ,, ,, |
| | Selama ,, | 3,450 | 3,450 | ,, | | — | ,, ,, 250 ,, ,, |
| | K. Kangsar Dist | 13,997 | 13,807 | — | | — | **Note.** 1. x. Acreages of padi land of Tejah, Ulu Kinta, Kampar, Tapah, Ulu Bernam and Slim mukims are not known. |
| | Upper Perak ,, | 3,877 | 3,739 | — | | — | |
| **(South)** | 9 Mukims. | 13,133x | 13,718 | Harvesting Progress = 12,426 acres<br>Harvesting completed = 1,292 acres | About 12,000 acres, poor crop being damaged by rats and 400 acres fair, but poor water control and late planting. | Total yield on 724 acres of Tejah, Ulu Kinta and Tapah Dist. mukims = **243,158** gantangs. | 2. Harvesting of wet padi in Lower Perak should be completed during the coming month. Reliable yield figures of wet padi are not yet available for Tanjong Malim Sub-District. |
| | Total Perak | 96,232 | 92,759 | | | | 3. **Areas of Dry Padi**<br>Acres. Yield.<br>Batang Padang 1932 334,027 gtgs.<br>Kinta 1476 241,467 ,,<br>Lower Perak 2438 not yet estimated |
| **Selangor** | Coast Districts | 18,564 | — | Nurseries completed = 4,710 acres<br>Harvesting completed = 13,160 acres<br>Nurseries now being sown | | | **13160 acres.** Fair, but as this padi is only a catch crop with coconuts a fair crop may not exceed 80 gantangs per acre. |
| | Inland ,, | 4,586 | | | | | |
| | Total Selangor | 23,150 | — | | | | |
| **Negri Sembilan** | 6 Districts | 37,296 | not yet planted | Preparing sawah | | | |
| **Pahang** | West | | | (See Remarks column) | — | — | **Dist. Raub** Sowing nurseries and preparation of nursery beds are in progress. Sowing nurseries are not in accordance with the scheduled dates, but later.<br>**Dist. Lipis, Temerloh & Bentong:**—Many areas are in transplanting seedlings, wherever water supplies are adequate, remaining still held up owing to shortage of water. |
| **Straits Settlements** | Pro. Wellesley | 33,228 | — | (See Remarks column) | | | Acreage of padi land in P. Wellesley North, South and central revised in 1930. Figure for Penang is not yet revised.<br>Preliminary ploughing and preparation of nurseries commencing. Scattered area 300 acres—Nurseries sown. |
| | Penang | 4,000 | — | | | | |
| | Singapore | Nil | — | | | | |
| | Malacca | 35,499 | — | | | | |
| | Total S.S. | 72,727 | — | | | | |

14th June, 1930.

(Sd.) L. GORDON CARRIE,
Statistician,
Dy. Registrar General of Statistics,
S.S. and F. M. S.

# METEOROLOGICAL SUMMARY, MALAYA. MAY, 1930.

| Locality | Air Temperature in Degrees Fahrenheit: Means of A. Max. | Means of B. Min. | Mean of A and B | Asolute Extremes: Highest Max. | Lowest Min. | Lowest Max. | Highest Min. | Earth Temperature: At 1 foot | At 4 feet | Rainfall: Total | | Most in a day: Amt. | Number of days: Precipitation* | Precipitation, 1mm. or more | Thunder-storm | Thunder heard | Fog morning obs. | Gale force 8 or more | Bright Sunshine: Total | Daily Mean | Per cent | Length of Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | °F | °F | °F | °F | °F | °F | °F | in. | mm. | ins. | | | | | | | hr. | hr. | % | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 91.6 | 73.1 | 82.3 | 96 | 69 | 86 | 75 | 84.9 | 85.0 | 6.10 | 157.0 | 3.56 | 8 | 7 | 4 | 12 | 5 | | 192.15 | 6.20 | 50 | 12.3 |
| Bukit Jeram, Selangor ... | 89.5 | 73.8 | 81.7 | 91 | 71 | 86 | 77 | 86.7 | 88.6 | 6.41 | 162.8 | 2.49 | 9 | 8 | ... | 12 | 1 | | 213.70 | 7.60 | 62 | 12.3 |
| Sitiawan, Perak ... | 91.5 | 73.7 | 82.6 | 95 | 69 | 87 | 76 | 84.9 | 84.5 | 3.41 | 86.6 | 1.52 | 8 | 7 | 11 | 20 | ... | | 217.85 | 7.03 | ... | .. |
| Kroh, Perak ... | 88.1 | 70.8 | 79.5 | 92 | 68 | 83 | 73 | 81.9 | 84.1 | 8.33 | 211.6 | 1.58 | 14 | 13 | .. | 7 | ... | | 205.70 | 6.63 | ... | ... |
| Temerloh, Pahang ... | 90.8 | 73.8 | 82.3 | 95 | 69 | 83 | 77 | 85.5 | 86.6 | 7.53 | 191.3 | 2.64 | 11 | 11 | 2 | 23 | 10 | | 186.25 | 6.01 | 49 | 12.3 |
| Kuala Lipis, Pahang ... | 89.6 | 72.5 | 81.1 | 93 | 69 | 86 | 75 | 84.3 | 84.1 | 8.77 | 222.8 | 2.56 | 14 | 13 | 11 | 20 | 17 | | 191.20 | 6.17 | ... | ... |
| Kuala Pahang, Pahang ... | 87.9 | 74.7 | 81.3 | 91 | 71 | 85 | 78 | 85.6 | 86.7 | 7.44 | 189.0 | 2.43 | 15 | 13 | 11 | 6 | ... | | 225.90 | 7.29 | 59 | 12.3 |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 73.6 | 60.8 | 67.2 | 78 | 59 | 70 | 62 | ... | ... | 7.16 | 181.9 | 1.40 | 16 | 16 | 5 | 19 | 3 | | 183.85 | 5.93 | 48 | 12.3 |
| Cameron's Highlands, Tanah Rata | 74.5 | 56.3 | 65.4 | 77 | 48 | 70 | 62 | 71.3 | 69.9 | 6.51 | 165.4 | 1.88 | 18 | 15 | 5 | 19 | 3 | | 175.85 | 5.67 | 46 | 12.3 |
| Fraser's Hill, Pahang ... | 75.2 | 63.9 | 69.5 | 78 | 62 | 72 | 66 | 72.6 | 72.8 | 5.78 | 146.8 | 1.58 | 17 | 14 | 8 | 16 | 21 | | 176.45 | 5.69 | 46 | 12.3 |
| Mount Faber, Singapore ... | 87.2 | 76.0 | 81.6 | 90 | 71 | 78 | 80 | 82.3 | 83.1 | 6.19 | 157.2 | 1.19 | 16 | 14 | 4 | 12 | ... | | 197.55 | 6.37 | 52 | 12.2 |
| Butterworth, Province Wellesley | 89.7 | 75.3 | 82.5 | 92 | 73 | 85 | 79 | 87.1 | 85.8 | 5.66 | 143.8 | 1.65 | 15 | 13 | ... | 10 | ... | | 233.55 | 7.53 | ... | ... |
| Bukit China, Malacca ... | 86.0 | 74.7 | 80.3 | 89 | 71 | 80 | 78 | 84.4 | 84.9 | 7.84 | 199.1 | 2.00 | 13 | 8 | 3 | 3 | ... | | 218.85 | 7.06 | 58 | 12.2 |
| Kluang, Johore ... | 88.9 | 72.5 | 80.7 | 93 | 70 | 77 | 75 | 82.9 | 82.9 | 6.41 | 162.8 | 3.54 | 8 | 7 | 1 | 11 | 7 | | 183.15 | 5.91 | 48 | 12.2 |
| Bukit Lalang, Mersing, Johore... | 88.5 | 73.1 | 80.8 | 93 | 71 | 79 | 75 | 82.9 | 82.6 | 5.27 | 133.9 | 1.29 | 16 | 14 | ... | 22 | 1 | | 197.35 | 6.37 | 52 | 12.2 |
| Alor Star, Kedah ... | 90.2 | 75.0 | 82.6 | 93 | 72 | 85 | 78 | 87.7 | 87.3 | 9.06 | 230.1 | 4.31 | 11 | 10 | 1 | 12 | ... | | 236.40 | 7.63 | ... | ... |
| Kota Bharu, Kelantan ... | 90.4 | 74.3 | 82.2 | 93 | 72 | 87 | 77 | 85.4 | 84.9 | 7.93 | 201.5 | 2.26 | 11 | 10 | 2 | 15 | 1 | | 295.90 | 6.64 | ... | ... |
| Kuala Trengganu, Trengganu ... | 90.1 | 73.7 | 81.9 | 93 | 71 | 87 | 76 | 85.0 | 85.7 | 4.02 | 102.1 | 0.91 | 15 | 13 | ... | 11 | 2 | 2 | 223.65 | 7.21 | ... | ... |

* Precipitation ·01 inch or more when measurement is in inches ·2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE

# Malayan Agricultural Journal

AUGUST, 1930.

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## EDITORIAL.

**Interdependence of Agriculture and Health Measures.**

The Malaria Advisory Board of the Federated Malay States appointed a Sub-committee to enquire into the subject of *Anopheles maculatus* breeding in silt and aeration pits on rubber estates. This Sub-committee consisted of officers of the Medical and Agricultural Departments, the Institute for Medical Research and the Rubber Research Institute of Malaya. The opinions and recommendations of the Sub-committee are embodied in the statement prepared by them and published in this number of the *Malayan Agricultural Journal.*

The Sub-committee has requested that the advisory officers of the Department of Agriculture should consistently emphasise the importance of the possible ill-effects on health of any agricultural methods involving pitting or draining. In view of the importance of maintaining the health of the labour force, agriculturists cannot afford to ignore such a warning.

The rapid development of tropical agriculture during the past twenty-five years has been made possible by the progress of medical science, and in this connection, the pioneer work of Sir Patrick Manson and Sir Ronald Ross's epoch making discovery of the rôle played by the mosquito in the propagation of Malaria has led to the adoption of sanitary and anti-malarial measures which have not merely rendered tropical agriculture an economic success, but have made possible the development of agriculture in regions that otherwise would have remained undeveloped.

Another great medical discovery is that connected with the name of Finley whose theory, propounded in 1881, on the cause of yellow fever was in 1900 confirmed by an American Commission whose findings led to a definite policy for combating this disease. Epidemics of yellow fever, so long associated with large tropical cities, ceased in consequence of the adoption of these measures, resulting in a marked effect on agricultural development especially in South America. One cannot, for instance, visualise the development of the Cuban sugar industry under the former yellow fever conditions.

In many other instances, medical science has conferred inestimable benefits on agriculture. Such maladies as hookworm, dysentery, beri beri, and yaws, took their not inconsiderable toll of the labour force and hampered agricultural deve-

lopment. The solution of these and many other medical problems has led not only to a reduction of the wastage of the labour force, but to a consequent marked influence on general labour efficiency.

It will be noted that the present trend of medical science is to concentrate more on the prevention of disease than to provide successful treatment; this can only be accomplished by endeavouring to secure higher standards of sanitation and hygiene than those previously accepted.

The co-operation of the public with the health authorities is essential if advantage is to be taken of the considerable research work achieved.

It is only by the efforts of planters, in consultation with their visiting medical officers, that strict sanitary measures can be economically operated. While planters should try to adopt agricultural practice to medical requirements, the equal recognition by sanitary authorities of agricultural requirements is also indicated. It is only in this way that health on estates can be maintained and improved. It is almost inevitable that at times the interests of the planter and the health authority should conflict. Such conflict of interests can only be overcome—and may in fact frequently be avoided—by close contact between the agriculturists and the health authorities that shall result in securing greater understanding and harmonious work to their mutual benefit.

**Large Scale Padi Planting.** The view is generally held that padi is an unsuitable crop for large scale production on account of the amount of labour necessary for its production and the difficulty of using heavy machinery owing to the irrigated condition of the land. While this view may be true for narrow valleys and areas on which adequate water supply is impossible, it has been refuted in the many countries that have perfected the essential requirements of this crop. The bulk of the world's supply of rice is still obtained from India, Siam, and Indo-China, where the cultivation is mainly in the hands of small holders, but the cultivation of the crop on a plantation scale is steadily increasing in importance. The growing demand for rice, which is hardly balanced by an increase of production from the above-mentioned three sources of supply, indicates that in the future, large scale production of rice will be a widely recognised agricultural policy.

Large scale production of rice has made considerable headway, for instance, in Spain, Northern Italy, California, Louisiana, and on another page of this number will be found an account by Mr. J. W. Jolly of an even more recent overture in the cultivation of wet rice under irrigation in Australia.

It is a significant fact that in all these countries where padi is grown on a large scale, the yields are higher than those obtained by native methods. For instance, Spain with over 100,000 acres produces an average of 5,000 lbs. of padi per acre, Italy with nearly 300,000 acres has an average crop of 3,600 lbs. per acre, California, over 100,000 acres gives an average yield of 2,660 lbs. per acre, Louisiana with nearly half a million acres gives an average crop of over 2,000 lbs. per acre. Contrast these figures with Malaya which has about 600,000 acres

under this crop, producing an average yield per acre of about 1,300 lbs. The Krian Irrigation area is an exception to the low local yields, the yields on that area been equal—if not surpassing—those of any other country. But this only emphasises the importance of perfect water control, which is given close attention in areas on which padi is cultivated on extensive holdings.

Summing up the reasons for the success of padi cultivation, one finds that not only is close attention given to the water problem, but that tractors and other machinery are extensively used, manuring is a usual practice, rotation of crops is recognised as a system of padi cultivation and—in Italy—animal husbandry is closely connected with the padi areas. The extent to which these systems are adopted, of course, depends on the local circumstances obtaining in the particular country.

The above stated instances give a denial to the idea that padi is only suitable for the small holder and point to the fact that once conditions in Malaya are adjusted to enable such methods to be employed, similar systems involving the use of machinery can be applied to rice just as to wheat, oats or barley.

While the day may be far distant when such schemes materialise, nevertheless, the idea of extensive new areas cultivated by intensive methods of cultivation can be visualised by those that are concerned with what is probably the most important problem of the tropics; namely, the future of the World's Rice Supply.

**The World's Trade in Rubber.** Attention is directed to an abstract in this issue of a recent Report of the Imperial Economic Committee on a Survey of the Trade in Rubber Manufactured Goods. The figures quoted in the review are significant in shewing the relative importance of the United States of America market, and the pre-eminence of her manufactures of all kinds of rubber goods; and the uncertainty of expansion in European countries.

The science of production has made great strides during recent years. This in itself renders of even greater importance economic studies of this description. In the present economic crisis, the application of scientific method to the study of economic problems is the only safe avenue of approach to discussing a remedy. It is for this reason that the series of economic studies of the Empire Marketing Board and kindred organisations are of such importance. The former body giving detailed attention to all the great Empire industries. A perusal of the Reports leads to an appreciation of present markets in the light of which it becomes more possible to adjust our ideas on production and future possible avenues for extending our markets.

**Coconut Cultivation.** Mr. B. Bunting, Agriculturist, as a result of an official visit to Ceylon, has presented a report which embodies his observations on various aspects of agricultural practice in that Colony. In view of the premium obtained for copra of Ceylon origin, planters in this country will be interested to read this study of the Ceylon methods of production.

## Original Articles.

# SILT-PITTING ON ESTATES IN RELATION TO MOSQUITO BREEDING AND MALARIA.

### A Report by the Malaria Advisory Board in conjunction with the Agricultural Department and the Rubber Research Institute.

Since silt-pitting became a widespread practice in rubber estates in the Malay Peninsula, the larvae of dangerous anophelines, notably of *Anopheles maculatus*, have been found by many observers and on many occasions in water standing in silt-pits both on hillsides and on comparatively flat land. The tendency for *Anopheles maculatus* to breed in such pits undoubtedly becomes greater where other natural waters are regularly and efficiently oiled, the anopheline being thus driven to breed in what might not naturally be selected as a breeding place. It may, therefore, be accepted that silt-pits and other trenches which hold water for sufficiently long intervals, and are situated within a radius of some forty chains from dwellings, are a menace to health. This state of affairs has led in some cases to an apparent conflict between the agricultural requirements of silt-pitting in rubber, and the medical requirements of antimalarial work; but the supposed antagonism becomes the less pronounced the more closely it is examined.

The main aim of all earthwork systems on undulating or hilly land is to stop surface wash of water during heavy rainfall, and to induce the water to percolate naturally through the soil. In old-planted rubber this is usually best attained by silt-pitting with bunds.

There is no necessity for water to be held in catchment pits for any length of time; indeed, it may be said that if the water remains for days at a time it is best from an agricultural, as well as from a medical point of view, that means should be taken for its quicker removal. If, therefore, the rate of percolation into the soil cannot be sufficiently improved, the measures taken should be made to simulate the normal drainage of flat land. Here stops are dispensed with, and the trenches form a continuous system, so that water can be readily carried off. On sloping land of such a heavy character the conditions to be aimed at would cause the contour drains to run to a common outlet, and with a view to preventing wash during heavy rain artificial stops of a pervious nature may be erected (rubble, brushwood, etc.) A system of this kind would let the water trickle away without permitting sudden rushes. Drainage systems on this principle for such special cases have already been reported as functioning successfully in Malaya.

Where the soil tends to be impermeable it is doubtful, however, whether any such steps can prove entirely adequate from a health point of view, since small puddles will always tend to remain at the bottom of the trenches however well they may be finished. These cases of great resistance to water penetration must be accepted as expensive and difficult both for antimalarial work and for soil cultivation. There is every reason that preventive measures against malaria (such as oiling) should be accepted as a standard practice in hill drains or pits under these circumstances, just as they are for other drains in flat land. The work will be more of a seasonal nature than on flat land.

To repeat, since silt pits or drains are necessary in old rubber, measures should be adopted within forty chains of dwellings for the prevention of anopheline mosquito breeding in any water retained in such pits or drains.

Such possible measures are:—

(a) Measures to prevent retention of excess water.

Although pits are used to conserve water in most cases, other cases arise in which removal by drainage is required just as on flat land.

(b) The use of larvicides, such as a suitable antimalarial oil mixture, applied in the usual way by spraying. The easiest method, however, for these particular conditions, is to apply liquid fuel (Diesel oil), with a very small mop. Oil applications on such stagnant water will be safe if done only once a fortnight. Such oiling of all water retained in pits in a residential area is being done at present by a number of estates as part of the regular anti-malarial work. Alternatively, the pits may be dusted with a dusting mixture containing Paris Green, which would need to be applied once in every five or seven days. Experience is not yet sufficient to compare the cumulative effects of such treatments upon the soil conditions.

(c) In flat land, trenches should be continuous, without stops. Small depressions on the land which retain puddles of water will be limited in number, and may be filled with loose soil without harm to the general agricultural system as regards rain percolation. In flat land deep water drains are advisable, connected with the natural drainage system of the area, and oiled or otherwise treated anti-malarially as part of that system.

## Drainage in New Clearings.

In residential areas, it is preferable to make bunds. On hillside land, these should be made in connection with terraces; on flat land, bunds can be made by drawing together the surface soil. Such systems should always be adopted in the anti-malarial areas in new clearings, in place of pitting or digging trenches, unless such special soil conditions exist as would make pitting indispensable. These systems may be chosen both on anti-malarial grounds and on their own merits as regards permanence and efficiency.

# COCONUT CULTIVATION IN CEYLON

BY

B. BUNTING,
*Agriculturist.*

## Introductory.

With a view to investigating the various methods employed in the cultivation of coconuts and the preparation of copra as practised in Ceylon, the writer paid visits in February, 1930 to nine coconut estates in the North-Western Province of Ceylon.

The estates visited were situated in the districts of Veyangoda, Kurunegala, Negombo, Chilaw and Puttalam, which are recognised as some of the most suitable districts in Ceylon for the cultivation of this important crop.

It is estimated that the total area planted with coconuts in Ceylon is approximately 1,000,000 acres, while the total value of exports of coconut products from the Colony during the year 1929 was Rs. 60,024,466.

*Exports of Coconut Products.*—The following figures show the quantity and value of the various coconut products exported from Ceylon during the year 1929:—

| | | Quantity. | Value. Rs. |
|---|---|---|---|
| Coconuts, fresh | ... | 20,821,284 nuts | 1,281,910 |
| Copra | .. | 2,042,488 cwts | 26,315,987 |
| Desiccated coconut | ... | 690,469 ,, | 11,875,780 |
| Coconut oil | ... | 878,523 ,, | 18,024,359 |
| Fibre, bristles | ... | 199,923 ,, | 1,713,667 |
| Fibre, mattress | ... | 395,468 ,, | 812,763 |

The above figures show a decrease of Rs. 7,964,337 in the value of exports of desiccated coconut compared with the year 1928. This is due to the loss of the American market owing to the high tariff which has been placed on this commodity in order to protect the Philippine industry.

At the request of the Ceylon Government, the Government of India has recently reduced the duty on fresh coconuts, which may cause a considerable increase in the exports of fresh nuts during 1930.

*Climatic Conditions.*—The following table shows the average rainfall and the number of rainfall days in the different districts:—

| *District.* | | Elevation *Feet.* | Rainfall *Inches.* | Rainfall *Days.* |
|---|---|---|---|---|
| Veyangoda | ... | 50 | 103.04 | 179 |
| Kurunegala | ... | 400 | 82.33 | 163 |
| Negombo | ... | 6 | 70.70 | 115 |
| Chilaw | ... | 12 | 53.55 | 113 |
| Puttalam | ... | 10 | 45.17 | 96 |

The mean temperature during the day varies from 85° to 90°F. in the shade.

### General Conditions of Estates.

*Situation of Estates.*—The estates at Kurunegala and Veyangoda are situated about 45 and 15 miles from the sea respectively, while those at Negombo, Chilaw and Puttalam are all near the sea coast.

*Nature of Land.*—The lay of the land in both the Veyangoda and Kurunegala districts is gently undulating, but in all the other districts it is practically flat.

*Soil Conditions.*—The following is a brief description of the type of soils found in various districts:—

(a) Veyangoda ... Light loam on the flats and red gravel on the mounds.

(b) Kurunegala ... Rich sandy loam or very light clay on flats, with lights red laterite on mounds.

(c) Negombo ... Light sandy loam, with areas of white sand deficient in humus.

(d) Chilaw ... Varies from sandy loam to clay loam.

(e) Puttalam ... Light sand to sandy loam.

*Area of Estates.*—The average areas of the coconut estates visited varies from 400 to 1,000 acres each, but the largest estate has approximately 1,400 acres planted with coconuts.

*Distance of Planting.*—On five estates the distance of planting was 25 ft. x 25 ft. square or 70 palms per acre, on three estates 26 ft. x 26 ft. square or 64 palms per acre and on one estate 27 ft. x 27 ft. square or 60 palms per acre. It is generally considered that the distance of planting is much too close and that a spacing of either 28 ft. x 28 ft. triangular (64 palms per acre) or 28 ft. x 28 ft. square (55 palms per acre) would give much better results, particularly on the richer types of soils.

*Age of Palms.*—The average age of the palms on eight different estates varies from 35 to 45 years, but on one estate the average age is stated to be from 50 to 60 years.

### Weeding.

The clean weeding of coconut areas is not practised in Ceylon and the majority of the estates are under light grass, which is usually kept grazed by cattle. On some estates, however, the grass is gradually being replaced by low-growing cover crops. Such areas are hand-weeded monthly, but those under grass are only weeded once in three months and this merely consists in the removal of shrub and the sensitive plant, *Mimosa pudica.*

### Cover Crops and Green Manures.

A few of the more progressive coconut planters are beginning to realise the value of low-growing leguminous cover plants and on quite a number of

estates the grass is gradually being removed and *Dolichos Hosei* (Vigna) planted in its place. In the majority of cases where Vigna has become established it has shown remarkably good growth and forms a very thick cover, about 6 inches deep.

On one estate, however, where Vigna had proved a complete failure, *Calopogonium mucunoides* and *Centrosema pubescens* were giving the best results in areas of mature coconuts.

In cases where the ploughing of alternate rows of the cover crop is practised once in two years the plant then acts as a green manure and thereby adds considerable amounts of nitrogen and organic matter to the soil. Under this method of treatment the Vigna will establish itself again without replanting, more particularly when the ploughing is followed by the application of artificial manures. Many estates which have been for years under grass are now being brought back into condition by cultivation and green manuring.

The more shrubby types of cover plants, such as *Tephrosia candida* (Boga medeloa) and *Crotalaria anagyroides*, are also being grown to a certain extent as green manures. In such cases the seed is usually sown in lines either between each row or between alternate rows of coconuts. When the plants begin to flower they are cut back at intervals of about 4 to 6 months and the loppings allowed to remain on the surface as a mulch. At the end of two years the whole plant is uprooted and ploughed into the soil as a green manure.

The more woody types of green manures, such as *Erythrina lithosperma* (Dadap), have also been given a trial on some estates for the purpose of green manuring, but the results have been far from satisfactory and their cultivation with coconuts is not recommended.

## Catchcrops and Intercrops.

On one estate, where an area of coconuts was interplanted with tea, annatto and fruit, the average yield was only 18 nuts per palm per annum, but a few years later, after the removal of these intercrops, the average yield on this particular area was increased to 62 nuts per palm per annum. This clearly indicates the danger of interplanting other permanent crops with coconuts.

## Soil Conservation.

On a number of estates, contour drains, with stops every 20 to 25 feet, are dug on the undulating land in order to prevent soil erosion. The spoil is thrown on the upper side of the drain to form a continuous bund as is commonly practised in Sumatra.

Another method adopted for the same purpose is the construction of platform terraces round each individual palm. These terraces are about 12 feet square with a fall opposite to the slope of the land. A pit, about 3 feet deep and 18 inches wide, is dug at the lower side of the terrace and filled with coconut husks, which eventually become covered with soil. One of these pits

was opened and on examination a number of feeding roots of the palm were found penetrating the decaying husks in search of plant food.

## Cultivation.

The general practice is to plough and harrow alternate rows every two years. The soil is usually ploughed to a depth of 6 to 8 inches and then harrowed with an ordinary disc harrow in order to break down the surface lumps.

On one estate ploughing is carried out once a year throughout the area and on another, each field is disc-harrowed only once every three months. Digging every alternate row with 'changkols' once in two years is also practised, but to a less extent.

During the operations of ploughing and harrowing, whether the land is under grass or green manure, large quantities of undecomposed vegetable matter are incorporated into the soil. This has the effect of improving the fertility of such light soils, which are naturally deficient in humus.

The results of experiments carried out at the Chilaw Coconut Trial Ground on a sandy soil clearly show that excessive cultivation on this type of soil and in such a dry district has resulted in a marked falling off in yield of copra per palm.

## Manuring.

Considerable attention has been given to the problem of manuring and it is now generally recognised in Ceylon that more satisfactory returns can be obtained from coconuts by the periodical application of artificial manures.

The general practice is to apply from 14 to 16 lbs. per palm of a complete mixture every two years, but under the present system of manuring alternate rows every other year, each palm actually receives half the above quantity once a year.

The composition of the mixtures of artificial manures employed on different estates varies considerably and it is somewhat questionable whether equally good results could not be obtained by limiting the mixture to three forms of fertilisers supplying the three necessary ingredients of plant food, namely nitrogen, phosphate and potash.

The following shows (a) the various mixtures employed, (b) the method of application and (c) the quantity applied in each case:—

(1) A mixture containing 4 parts muriate of potash, 8 parts double kainit, 8 parts steamed bone meal, 10 parts crushed fish and 6 parts nitrate of soda.

This mixture is applied broadcast in strips 8 feet wide down the centre of the rows at the rate of 15 lbs. per palm once in two years.

(2) A mixture consisting of 30 per cent. crushed fish, 30 per cent. steamed bone meal, 10 per cent. nitrate of soda, 10 per cent. nitrate of potash and 20 per cent. muriate of potash.

This is broadcast in the rows, which have recently been ploughed, at the rate of 14 lbs. per palm every other year.

(3) A mixture composed of 4 lbs. fresh fish (crushed), ½ lb. nitrate of potash, ½ lb. muriate of potash, 3 lbs. steamed bone meal, 2 lbs. calcium cynamide and 2 lbs. Sylvinite (double kainit).

This is applied at the rate of 12 lbs. per palm every two years.

(4) A mixture of 6 parts steamed bone meal and 4 parts Sylvinite.

This mixture is broadcast in 4 foot circles, about 9 feet from the palm, at the rate of 12 lbs. per palm every two years.

(5) A mixture consisting of 8 lbs. steamed bone meal, 3 lbs. groundnut meal, 2 lbs. Nitrolim and 3 lbs, of sulphate of potash.

This is applied in circles 3 to 4 feet wide and 4 feet from the palm at the rate of 16 lbs. per palm every two years.

(6) A mixture comprising 8 lbs. steamed bone meal, 5 lbs. fish guano and 3 lbs. muriate of potash.

This mixture is applied in circles 3 feet wide and 3 feet from the palm, at the rate of 16 lbs. per palm once in two years.

(7) A mixture consisting of 3 parts calcium cynamide, 9 parts Seychelles guano, 3 parts Sylvinite and 5 parts kainit.

This mixture is broadcast in 8 foot strips between the rows at the rate of 20 lbs. per palm every alternate year.

## Manuring Experiments.

The results of manural trials carried out at the Manning Coconut Trial Ground, Negombo, on a light sandy soil, show that good yields can be maintained on such soils by the addition of organic matter in the form of coconut husk combined with the application of potash.

The best results, however, were obtained by the application of a complete mixture consisting of 3 lbs. bone meal, 2 lbs. castor cake and 1lb. sulphate of potash. This mixture was applied at the rate of 8 lbs. per palm every year, i.e. half circles are manured every alternate year.

The following figures show the yield of nuts and copra obtained from the plot receiving the above mixture during the period 1925/1928:—

| | *Yield Per Plot of ½ acre.* | | *Calculated Yield per acre.* | |
|---|---|---|---|---|
| | *Nuts.* | *Copra. lbs.* | *Nuts.* | *Copra. lbs.* |
| 1925 | 1,279 | 749 | 2,558 | 1,498 |
| 1926 | 1,420 | 843 | 1,840 | 1,686 |
| 1927 | 1,719 | 1,029 | 3,438 | 2,058 |
| 1928 | 2,152 | 1,246 | 4,304 | 2,492 |

In view of the poor type of soil on which these trials are being carried out the yields are remarkably high and are undoubtedly the direct result of manuring.

The former system of manuring was to tether cattle under the palms. The practice was to tie two head of cattle up to a palm for a period of 10 days and then dig the manure into the soil. It is estimated that under this system of manuring one head of cattle is required for every acre under grass. With the reduction of the areas under grass, owing to the planting of cover crops, very few cattle are now kept specially for this purpose, but use is still made of the working bulls.

With a view to determining the annual wastage of plant nutrients the following is a complete record of the various plant products removed annually from half an acre of coconuts, containing 35 palms, at the Manning Coconut Trial Ground:—

| | | *Plant Products from ½ acre.* lbs. | *Plant Products from 1 acre.* lbs. |
|---|---|---|---|
| Branches | ... | 2,644 | 5,288 |
| Flower Stalks | ... | 760 | 1,520 |
| Husks | ... | 2,728 | 5,456 |
| Water in nuts | ... | 577 | 1,154 |
| Poonac | ... | 339 | 678 |
| Shells | ... | 743 | 1,486 |
| Total | ... | 7,791 | 15,582 |

It will be seen that the husks form a large proportion of the plant products removed annually and therefore it is considered desirable that these should be returned to the soil in order to reduce the wastage of plant nutrients.

Although fair quantities of husks are consumed in the manufacture of coir fibre, it is the general practice on estates to make use of the husks either for mulching or manurial purposes. The nuts are always husked in the field after which the fibrous husks are usually placed in circles round the base of the palms, or in the rows between the palms, as a surface mulch. On some estates, however, the husks are placed in shallow trenches and covered with soil in order to accelerate their decomposition and thus provide additional plant food.

## Diseases and Pests.

Bud-rot and stem-bleeding disease cause a certain amount of damage to coconuts in the North-Western Province.

The principal pests are the Black beetle, *Oryctes rhinoceros*, and the Red weevil, *Rhynchophorus ferrugineus*. An entirely new pest recently made its appearance on one coconut estate and is called the Nettle grub, *Parasa lepida*, which defoliates the mature leaves of the palm.

Lightning strike is frequently responsible for the loss of whole groups of palms on many estates.

## Harvesting Nuts.

The system of harvesting the nuts at regular intervals of two months is universally adopted on coconut estates in Ceylon. This gives six pickings a year and an average of two bunches per palm is harvested at each picking. The nuts are usually harvested by means of a bamboo and knife, but on some estates the coolies climb the palms and pick the nuts by hand. When hand-picking is adopted the harvesting coolies clean up the palm after picking the ripe bunches. Under the latter system of harvesting a cooly will pick from 750 to 1,000 nuts per day.

Bamboo picking is usually done on contract at a cost of 50 cents, per thousand nuts and a good picker will harvest up to 2,000 nuts per day under ordinary conditions.

It is stated that there is such a variation in the colour of nuts from different palms that colour gives little or no indication of ripeness and nuts from certain palms may be quite green when fully ripe. As a rule the nuts are just beginning to fall when the crop is due to be harvested. The interval of two months between the harvesting periods ensures that the nuts are fully ripe when harvested.

There is a considerable variation in the crops harvested at different seasons of the year and the following table shows the distribution of the crop over the past two years on an estate of over 400 acres:—

| *Date of Picking.* | *1928.* | *1929.* |
|---|---|---|
| January ... | 139,000 | 160,000 |
| March ... | 261,000 | 280,000 |
| May ... | 399,000 | 319,000 |
| July ... | 278,000 | 351,000 |
| September ... | 296,000 | 273,000 |
| November ... | 206,000 | 184,000 |

It will be seen that the heaviest crops are obtained during May and July, which are usually wet months.

## Yield of Nuts.

There appears to be a wide variation in both the yield of nuts per palm and nuts per acre on estates in different districts, which may be due partly to differences in climatic conditions, but most probably to variations in the types of soil on which the palms are planted.

The following table shows the average yield of (a) nuts per palm and (b) nuts per acre on the various estates visited. Particulars are also given of the approximate age of the palms and the average annual rainfall on the estates in question:—

| *Estate.* | *Approximate age of palms.* Years. | *Number of nuts per palm.* | *Number of nuts per acre.* | *Average annual rainfall.* Inches. |
|---|---|---|---|---|
| "A" | 25 to 50 | 49 | 3,250 | 114 |
| "B" | 15 to 45 | 72 | 4,000 | 90 |
| "C" | 35 to 40 | 67 | 3,750 | 82 |
| "D" | 25 to 35 | 68 | 3,600 | 95 |
| "E" | 50 to 60 | 60 | 3,750 | 80 |
| "F" | 20 to 25 | 72 | 4,000 | 80 |
| "G" | 35 to 40 | 58 | 3,500 | 55 |
| "H" | 35 to 45 | 85 | 5,600 | 56 |
| "I" | 35 to 40 | 65 | 4,000 | 45 |

The distance of planting ranged from 25 ft. × 25 ft. to 27 ft. × 27 ft. square on the different estates.

The following figures show the yield of nuts per acre from the three highest and the three lowest-yielding fields on one estate, which gave an average yield of 5,586 nuts per acre over an area of approximately 1,250 acres during 1929:—

(a) *Highest-Yielding Fields.*

No. 1 = 6,375 nuts per acre.
No. 4 = 6,296 ,, ,,
No. 14 = 6,235 ,, ,,

(b) *Lowest-Yielding Fields.*

No. 9 = 5,146 nuts per acre.
No. 13 = 5,203 ,, ,,
No. 11 = 5,216 ,, ,,

The system of manuring adopted on this estate is to apply 20 lbs. of a complete mixture per palm every alternate year and it is possible that this heavy dressing of artificials may be largely responsible for the phenomenally high yields which are now being obtained.

## Preparation of Copra.

In the manufacture of copra it is essential that only ripe nuts should be harvested since immature nuts are known to produce copra of inferior quality.

After picking, the nuts are collected in small heaps of 3,000 to 4,000 nuts, where they remain for a period of three to four weeks in dry weather, which may be extended to five weeks during wet weather. The nuts are then husked in the field and the husked nuts transported either by bullock carts or light railway to a central kiln, where they are made into copra.

The system adopted on one estate was to let out husking, splitting and the whole manufacturing process on contract at a cost of Rs.1.75 to Rs.2/- per thousand nuts. The nuts are counted in the field and again after husking on arrival at the kiln, while a third count is made of the two halves of the kernel after drying is completed.

The common methods of drying the kernels are (a) sun-drying and (b) kiln-drying, but as the former method can only be carried out successfully during continuous spells of dry weather it is only suitable for the dry districts. Consequently, the general practice on most coconut estates in Ceylon is to resort almost entirely to kiln-drying. Under this system, however, it is found necessary to dry the newly-opened nuts in the sun for at least one day in order to get rid of the surplus water which comes from the inside of the nut.

The following is a description of the types of kilns and the methods of drying employed on eight different estates:—

*Estate "A"*.—The kiln is a permanent type of building constructed of brick sides, faced with cement, a corrugated iron roof and concrete floor. The building is roughly 60 feet long by 24 feet wide, giving a drying platform of about 60 ft. x 16 ft. It consists of 5 bays, each about 12 feet long and 16 feet deep, with a verandah of 8 feet wide in front of the platform. Each bay will hold about 8,000 nuts as a maximum, which gives a kiln capacity of 40,000 nuts. It is, however, usually working at a capacity of 20,000 nuts.

The drying platform is constructed of iron girders, carrying wooden joists, spaced about 18 inches apart, over which are placed strips of areca-wood, roughly 1½ ins. x ½ in., as close together as possible. The unevenness of the battens gives ample spacing to allow the heat to pass through to the drying kernels. In addition, No. 3 or 4 gauge wire mesh is placed on top and tied down with wire to prevent small pieces of copra falling through into the firing pit below. It is stated that this precaution saves a loss of about 1½ per cent. of copra. The platform is placed one foot below the top of the front wall, which is 4 ft. 3 ins. above the verandah level.

The firing pit is roughly 4 ft. 6 ins. below the level of the verandah so that the firing floor is about 8 feet below the level of the platform, which is considered the most suitable height. The firing pit is divided by a brick wall so as to form two compartments, one of two bays and one of three bays. Holes, about 3 ft. x 3 ft., at the front of the platform, one in each chamber, allow access to the firing pits, which are connected with the verandah by cement steps. Shallow steps are also placed inside the verandah in front of each bay in order to facilitate placing the nuts on the platform. The lower half of the verandah is built up to a height of about 5 feet, but the ends are left open. The wall at the back of the platform is either pigeon-holed or not, and built right up the eaves to allow fumes and moisture to escape. A shallow jackroof, placed about 6 inches above the main roof, will answer the same purpose.

When the nuts arrive at the kiln they are split in half and providing the weather is dry, placed on a cement barbecue for two days, but during wet weather they are placed straight on the kiln. The opened nuts, which have

been partially dried in the sun, are then placed haphazard on the kiln to a depth of about 12 inches with ordinary crops. When heavy crops are obtained the nuts are stacked 18 inches deep on the platform, but in this case they must be turned twice daily. Under ordinary conditions nuts will remain on the kiln for 4 days. After two days on the kiln the shells are removed and the kernels transferred to the next bay for further drying and so on until the fourth bay is reached, when the copra should be quite dry. The object of moving the kernels to the next section is to ensure evenness in drying.

The firing is done by placing a double row of shells side by side, each shell fitting closely into the next, across the floor of the firing pit. When the nuts have been partially sundried, the double rows of shells are spaced about 6 feet apart on the floor of the firing pit, but during wet weather, when the nuts are placed straight on the kiln, the rows of shells are spaced about 3 feet apart. The shells are lighted at one end so that the fire creeps slowly to the other end of the pit. The shells usually burn at the rate of 8 feet per hour, so that with a platform 16 feet wide one firing will take about 2 hours to complete. Firing goes on almost continuously, a fresh fire being started immediately the nuts have been turned over on the platform.

During windy weather the entrance to the firing pits are covered with sheets of corrugated iron so as to prevent too much draught. It is most important that the shells used for firing should be quite dry so as to produce as little smoke as possible, because if they are wet the smoke will discolour the copra.

When the kernels are quite dry they are transferred to the copra store. This building, which is constructed of corrugated iron, is raised about 8 feet above the ground and has a wooden floor on which the copra is stored until sufficient quantity is obtained to make a consignment. By storing the copra in this way it is kept free from mould.

In dry weather small fires are kept burning at night outside the kilns and copra stores to absorb dew. These fires are lighted early in the evening and early next morning, since little dew falls during the night.

It is considered that small kilns with a platform 40 ft. x 15 ft., placed in fields of 150 to 200 acres each, are preferable to a large central kiln since the former method tends to reduce the cost of transport of nuts.

*Estate "B".*—The kiln is a permanent structure of steel and brick, faced with cement. The building is roughly 80 ft. x 27 ft. and consists of 8 bays, each 10 feet wide and a platform 11 ft. 6 ins. deep. The firing floor is 6 feet below the platform and the verandah 14 feet wide. One bay will take about 5,000 nuts so that the total capacity of the kiln is 40,000 nuts.

When the husked nuts arrive from the field they are split in half and placed on a cement barbecue for 12 hours in the sun. They are then transferred to the kiln, where they are stacked haphazard to a depth of about 18 inches. Firing is done at night only and double rows of dry coconut shells placed into each other as close as possible, spaced at distances of 3 feet apart, are used for this purpose. Only one firing is given during the night and the shells are removed after the first day's firing. The kernels are then removed to the next

bay and shifted to the adjoining bay each day, the firing process taking 8 days to complete. It is undesirable to have a very high temperature, a steady heat throughout the drying process giving the most satisfactory results.

The kernel is separated from the shell by means of a thin piece of areca-wood about 18″ × 1″ × ¼″ in size, great care being taken to avoid breaking the kernel.

*Estate "C"*.—The kiln is of brick with steel framework, cement/asbestos roof and concrete floors throughout. The loft or platform is constructed of iron girders carrying wooden rafters 18 inches apart over which are placed teak battens, 2″ × 1½″ laid on edge at distances of 1½ ins. apart. There is a space of 7 feet between the firing floor and the platform on which the nuts are placed for drying. The firing pit is divided into three compartments by brick walls. In addition to a six inch jack-roof there are two ventilating holes above the platform on each bay, but none in the pits. This differed from other kilns in having an open verandah on the front.

The size of the platform is 60 feet long and 15 feet wide, which is capable of taking about 16,000 nuts.

The split nuts are placed direct on the kiln and there is no sun-drying. Double rows of coconut shells are placed at distances of 6 to 8 feet apart on the floor of the firing pit. Two rows are connected so that it takes about 4 hours for the shells to burn across the loft and back again. The nuts are then allowed to cool down for 3 hours before giving a second firing and are removed to the next bay before the third firing. After the third firing is finished the shells are removed, care being taken not to break the kernels, and three more firings are given to complete the process. The firing is continued night and day, the whole drying process taking from 3 to 4 days to complete. The copra is then sorted and the raw kernels given an additional firing.

*Estate "D"*.—The kiln is much the same type as those described above. The split nuts are sun-dried on a barbecue for one day and then transferred to a kiln, where they remain for about 5 to 6 days.

*Estate "E"*.—There are two kilns situated in different parts of the estate. When possible, sun-drying is carried out on this estate, otherwise the procedure is one day sun-drying and 4 days drying on kiln.

*Estate "F"*.—The split nuts are placed on barbecue and sun-dried for 1 or 2 days. They are then transferred to the kiln, where they remain for a further 5 or 6 days.

*Estate "G"*.—The split nuts are sun-dried on a barbecue for one day and then transferred to the kiln for 4 or 5 days to complete the drying process.

*Estate "H"*.—Sun-drying is carried out when possible, but when the conditions are unfavourable, the split nuts are dried in the kiln, which usually takes 5 to 6 days to complete.

It will be seen from the above descriptions that, although there are slight variations in the design of the kilns and the duration of firing on different estates, the general principle of kiln-drying is much the same throughout. Further, it is the practice on all estates to keep the two halves of the kernel intact

as far as possible and any small broken pieces are usually removed in the process of grading and sold as a separate grade.

It is generally recognised that sun-drying produces the best quality copra, and whenever the weather conditions are favourable, some estates employ this method of preparing copra in preference to kiln-drying. The process of sun-drying usually takes from 7 to 9 days to complete and it is therefore necessary to provide large cement barbecues for this purpose. The kernels should be covered up at night so as to afford protection from heavy dew, since any dampness on the kernels during the drying process will result in the copra becoming discoloured and mouldy.

### Grading and Packing.

When the drying process is complete the copra is transferred to the copra store, where it is sorted into three distinct grades as follows:—

No. 1 grade—Hard, good colour and not transparent.

No. 2 ,, —Soft, and wrinkled on the outside.

No. 3 ,, —Discoloured on the outside, due to immature nuts.

The copra is then packed in bags, each of which contains about 88 lbs., for sale in Colombo.

It is stated that a much better average price is obtained by grading the copra since the lower grades, when separated, realise almost the same price as the No. 1 grade, but if left in the bulk their presence lowers the price considerably.

### Yield of Copra.

The ratio of the number of nuts required to produce a candy (one candy = 560 lbs.) of copra varies at different periods of the year. During droughts the nuts begin to fall before they are fully matured so that they are much lighter in consequence. The age of the palm and the fertility of the soil also influence the relative proportions of nuts to weight of copra.

Under ordinary conditions it might take from 1,000 to 1,200 nuts to produce a candy of copra while the average yield of copra may vary from 3 to 4 candies per acre per annum.

The following table shows the average number of nuts required to produce a candy of copra and the average yield of copra on nine different estates:—

| *Estate.* | *Number of nuts per candy.* | *Yield of copra per acre.* | *Yield of copra per acre.* |
|---|---|---|---|
| | | candies. | lbs |
| "A" | 1,200 | 3 | 1,680 |
| "B" | 1,300 | 3 | 1,680 |
| "C" | 1,341 | 3 -3½ | 1,820 |
| "D" | 1,287 | 3 -3½ | 1,820 |
| "E" | 1,100 | 3¼-3½ | 1,890 |
| "F" | 1,000 | 3 -3½ | 1,820 |
| "G" | 1,260 | 3 -3¼ | 1,750 |
| "H" | 1,189 | 4 -4½ | 2,380 |
| "I" | 1,100 | 3 -3½ | 1,820 |

It is stated that an average yield of 3 to 3½ candies of copra per acre on some of the lighter types of soil can only be maintained by adopting a regular system of cultivation and manuring.

## Cost of Production.

The average cost of production of copra varies from Rs. 35/- to Rs. 40/- per candy (560 lbs.), but one estate was actually producing copra at Rs. 30/- per candy.

*Prices of Coconut Products.*—The price of copra varies from Rs. 60/- to Rs. 65/- per candy (560 lbs.), delivered in Colombo, while fresh nuts usually realise from Rs. 50/- to Rs. 55/- per thousand in the local market.

## General Conclusions.

It is well known that Ceylon copra realises a higher price than Straits copra when sold on the European markets. The difference in price may be attributed to the fact that Ceylon copra has not only a better appearence but is stated to contain from 2 to 3 per cent. more oil than the Straits product.

Although copra is sold on its general appearance and not on its chemical analysis, the valuation is based on the fact that good appearance indicates that the copra has been carefully dried and therefore contains a minimum percentage of moisture and a low percentage of free fatty acids.

The method of preparation of copra adopted in Ceylon, which usually consists of one day sun-drying and 5 to 6 days kiln-drying, tends towards uniformity in the product. Further, the use of dry shells for firing produces a steady heat throughout the drying process and prevents the kernels becoming discoloured by smoke, which naturally detracts from the value of the copra.

The grading of the copra according to colour, size and firmness before placing it on the market invariably results in a better average price being realised for the product.

Among other factors which may possibly affect the oil content of the copra are differences in soil and climatic conditions. In this connection it may be mentioned that in Ceylon the palms are planted much closer than is the case in Malaya and they produce a larger number of smaller nuts, which means that it requires a greater proportion of nuts to produce a given weight of copra.

The oil content of the copra may also be influenced by the degree of ripeness of the nuts at the time of harvesting or the period of storing between harvesting the nuts and drying the kernels and both these factors require investigation.

The writer wishes to express his indebtedness to the Proprietors and Superintendents of the various coconut estates visited for the valuable assistance and advice which was so freely given to him in connection with his investigation of the coconut industry in Ceylon.

# RECENT FIELD OBSERVATIONS ON RUBBER

BY

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*Chief Agricultural Field Officer.*

The following general remarks on rubber production during the first five months of the year are summarised from the monthly reports of the Principal Agricultural Officer, Johore, and of the Agricultural Field Officers in the different States of the Federation and Settlements of the Colony.

## Prices.

Rough average prices for rubber from small-holdings in dollars per pikul ($133\frac{1}{3}$ lbs.) have been:—

| | Smoked Sheet | Air-dried Sheet | Bark Scrap | Earth Scrap |
|---|---|---|---|---|
| January ... | — | 27-29 | — | — |
| February ... | 31-34 | 27-30 | 8-10 | 5- 8 |
| March ... | No | changes | recorded | |
| April ... | 25-28 | 15-26 | 8-11 | 6-10 |
| May ... | 20-30 | 10-27 mostly 25 | 5-12 | 5-11 |

The monthly average price of rubber (per lb.) in Singapore has been as follows:—January, 24.6 cents; February, 26.25 cents; March, 25.43 cents; April, 24.68 cents; May, 23.36 cents.

The price in the country tends to be about two dollars a pikul lower than it is for the same quality in the towns. In Pahang, probably owing to increased transport charges, the price is usually about one dollar a pikul lower than it is in the western part of the Peninsula.

## Wintering.

Between the middle and end of January a very well marked and heavy "wintering" commenced almost all over the Peninsula; it continued throughout February and had terminated in most localities by the end of March or the first week in April, though in Pahang West the wintering commenced about two weeks later than it did elsewhere and did not terminate until almost the end of April. The very dry weather during the first three months of the year was

the cause of this very definite "wintering" period, though showers at the end of March in most places and in the second half of April in Pahang West aided considerably the development of the young foliage.

In Province Wellesley, the drought necessitated special precautions on many large estates in order to prevent leaf fires. Such fires occurred on a number of small holdings in Johore during the dry wintering period, but the reports contain no references to any bad leaf fires in other parts of the country.

### General Maintenance.

The low price of rubber has had an undesirable effect on the standard of maintenance of many small holdings, comments on this point being made both from Pahang West and from Selangor. In some Districts of the latter State certain holdings are reported to have been abandoned.

On the other hand, in Singapore Island during the May tapping holiday, quite a number of the Asiatic owners of rubber land devoted a certain amount of time and money to such operations as cleaning silt pits and clearing undergrowth from the more heavily overgrown areas. In Malacca also it has been found that routine advisory visits to small holdings by the Agricultural Field Officer and his staff of Malay Officers are yielding results in improved maintenance, better general sanitation and better tapping.

### Soil Conservation.

The Agricultural Field Officer, Pahang West, states that undoubtedly more use is now being made by Asiatic planters, particularly Chinese, of a combination of cover crops and terracing and to a less extent of silt pitting as measures against soil erosion on hilly lands. A similar tendency may be observed in other parts of the Peninsula.

It is understood that a soil conservation condition, requiring the construction of silt pits and the planting and maintenance of a cover crop, has been introduced into the titles to all alienated land of a hilly nature in the Districts of Raub and Bentong. A similar condition is likely to be imposed in the case of hilly land in Jelebu District of Negri Sembilan though in the latter district the construction of terraces may also be required.

### Catch Crops.

Further areas of bananas have been planted up recently as a catch crop with young rubber in Western Pahang. The market for bananas, however, would appear to be saturated, at least temporarily, and the prices obtained at present are exceedingly low. Ginger is also coming into favour with Chinese small holders in Pahang as a catch crop with rubber although it is not so commonly found as are groundnuts and soya beans.

### Tapping and Yields.

In Pahang West the tapping systems most commonly found on small holding are one cut on ½ or on 1/3 of the circumference of the tree, tapped daily. Bark removal is often heavy, being as much as 2 or 2½ inches a month.

In the more remote localities two or three superimposed cuts are still to be found. The daily tapping of single cuts as described above is probably fairly general on small holdings throughout the country. Tapping on Chinese owned holdings is usually fairly good, but on Malay owned holdings whether tapped by the owner, or by a Chinese on a half share of the latex, deep tapping and wounding are common.

In the first two months of the year the prevailing drought and "wintering" caused a considerable decrease in yield. This, combined with the low market price led to deeper tapping, often accompanied by severe wounding, in an effort to obtain more latex from the trees. The fairly general attempt to obtain increased yields of latex on small holdings took a peculiar form in Penang Island and parts of Johore. The depressing effect of the hot dry weather and warm wind on the flow of latex during the normal tapping hours led some tappers in Penang Island to begin work at 3 a.m. when the maximum humidity is said to occur. They worked by the light of torches fixed to their foreheads. In Johore also the practice of tapping before dawn was adopted on many small holdings sub-let to Chinese. This tapping by insufficient light often led to wounding.

In parts of Pahang West during March, the joint effect of wintering and the long drought so depressed yields that tapping had to be stopped. In the same month it was estimated from field observations that more than half the rubber in Singapore Island was out of tapping. Although the yield of latex improved in Province Wellesley at the end of March after wintering, yet in April it was recorded that many small holders had stopped tapping on account of the low price of rubber, being unable to pay tappers' wages. In the majority of cases tappers' wages had to be reduced.

With a view to restricting output, a few estates stopped tapping as early as March, during the actual wintering period. More general action on these lines, however, was not undertaken until the adoption of the May tapping holiday proposed by the Rubber Growers' Association.

The extent to which both estates and small holdings actually adhered to the scheme for a tapping holiday in the month of May itself appears to have varied somewhat in different parts of the country. It is reported, for example, that in Province Wellesley all estates observed the holiday, while the majority of small holders carried on tapping vigorously. In Southern Perak, morning rain in the early part of the month made tapping impossible, but apart from this a number of European estates continued to tap as usual and little difference was noticed in the amount of tapping done by Asiatics. In Pahang West, the majority of the Chinese holdings of 50 acres or upwards, of which the owners were probably in the main members of the Asiatic Planters' Association, together with the majority of European estates were out of tapping throughout the month. Certain European estates were, however, out of tapping for one week only. No attempt was made to organise the small holders as was done in some of the Western States and Settlements. In Singapore, on considerable areas, including quite a number of small holdings, the tapping holiday was

observed. It was, however, noticeable during the last week of the month that some small holdings were recommencing tapping owing undoubtedly to lack of funds which prevented the owners from holding out for the full month. Lack of funds probably operated against the observance of the tapping holiday by many Malay small holders all over the country.

### Budded Rubber.

Imports of budwood, budded rubber and rubber seeds from the Dutch East Indies still continue in large quantities. The amounts arriving during the first five months of the year were:—23,591 metres of budwood, 40,602 budded stumps and 95,000 selected seeds.

While the great bulk of this material has been imported for European owned estates all over the country, the records show that a few consignments have been sent to three privately owned Chinese estates in Selangor, Johore and Kedah. Other records of the interest of Chinese owners in this method of obtaining increased yields are supplied from Batang Padang District of Perak and the Raub District of Pahang. In the former area a local Towkay is enthusiastically carrying out a budding programme on his estate with budwood grown in Selangor, while in Raub District a Chinese owned estate of 400 acres of trees from 18 to 24 months old was budded with the Selangor clone Sungei Reko No. 9 and a 70% success was obtained from the first budding.

It may be mentioned in passing, that in order to meet the increased interest in budding evinced by Asiatic rubber planters, a full account of the technique of budding, written by Mr. Mann of the Rubber Research Institute, is being prepared for publication in the next number of the Malay and of the Chinese Agricultural Journal.

Three estates in Selangor are now exporting budwood and budded stumps of their best clones to British North Borneo, Ceylon, Burma and the Netherlands East Indies. The quantities exported during the first five months of the year were:—140 metres and 285 yards of budwood and 2704 budded stumps.

### Manufacture.

A certain number of estates continue to make sole crepe which has commanded a premium of about 8 pence per lb. over the current market price for smoked sheet.

One estate in Johore commenced to export Revertex in February.

Some years ago alum was a popular coagulant on small holdings. Owing, however, to its harmful effect on prepared rubber, steps were taken to prevent its use. Recent enquiries show that, except in one or two remote localities in Kedah and Kelantan, it is now rarely to be found on small holdings and that acetic acid is the one coagulant now generally used.

Most Malay owners of small holdings prepare their rubber in the form of air-dried sheet. In some localities, however, they make smoked sheet, as for example in the holdings around Pekan on the east coast of Pahang where they are reported to produce smoked sheet of very fair quality. Chinese small

holders, on the other hand, usually make smoked sheet and a number undertake to smoke rubber for their Malay neighbours at a price of one cent a sheet. While this method of dealing with his rubber may often commend itself to the Malay owner, he is, nevertheless, liable to become the victim of fraud. An instance of this occurred in Selangor where the Malays suddenly discovered that they had been cleverly swindled for years by the local smoke-house proprietor. The latter purposely manufactured smaller sheets from the latex derived from his own trees and delivered these when smoked to his clientèle, retaining as his own the larger sheet brought to him for smoking. It is understood that the Malays in this vicinity have recently co-operated to provide their own smoke house.

Two Co-operative Societies have been formed among Malay owners of rubber land in Selangor for the purpose of erecting jointly owned factories and smoke-houses to treat the latex belonging to the members, and so to ensure a better quality product. This will not only command a better price on account of its superior quality, but being produced in considerable quantity, can be sold direct to a large dealer, so that the profits of the lesser middlemen are saved for the owners. The factories for these two Societies are in course of erection under the supervision of officers of the Co-operative Department who also obtained for the Societies plans of a suitable type of factory and smoke house. It is expected that one of these Co-operative factories will be ready to commence working in June.

The initial steps in the formation of these Societies have to be made very carefully and thoroughly, so that the members fully understand the method by which the capital required is raised and the system on which the factory will be operated and they themselves will receive payment for their produce. Progress is, therefore, slow at first, but if the two factories now under construction prove successful in operation, it will be possible somewhat more rapidly to found and equip other societies in the same way. There is already a demand for such factories and smoke houses from several groups of Malays, each group owning a sufficient area of rubber holdings to provide the necessary supply of latex.

## Diseases and Pests.

The long period of dry weather had a beneficial effect in decreasing very noticeably the prevalence of the diseases caused by fungi which depend for their active growth on moist conditions, such as Mouldy Rot and Black Stripe of renewing bark and Pink Disease on branches and stems. All such diseases, where they have occurred, have been kept under satisfactory control without much difficulty. During recent months there has been a marked increase in the number of small-holders who voluntarily undertake preventive painting at regular intervals to control Mouldy Rot disease. Many of these owners have now come to realise that if they carry out preventive painting regularly, it is usually unnecessary to order them to stop tapping their trees and that in consequence, they are far less liable to incur the loss involved when their untreated

trees have become so badly diseased that cessation of tapping becomes an essential item of any really effective treatment.

While the dry weather and heavy wintering had their beneficial effect in the control of the diseases mentioned above, they were not without an accompanying harmful side which was chiefly manifested as regards diseases in two ways. On many small holdings in Johore and elsewhere the damage already caused by excessively deep tapping was accentuated by sun-scorch, now well recognised as a form of damage frequently experienced when the absence of leaves on the trees exposes the thin renewing bark to the direct rays of the sun.

The other form of disease encouraged by the dry conditions was secondary leaf fall caused by the fungus *Oidium Heveae*. This disease was found to be prevalent in parts of Southern Perak, Selangor, Negri Sembilan, Malacca and Northern Johore on the young leaves and flowering spikes of the rubber trees as they emerged at the end of the wintering period. This fungus in Malaya appears to be dependent on dry conditions for its active spread; it gradually disappeared with the advent of more showery weather at the end of April and the beginning of May and ceased to be in evidence after the young leaves had developed sufficiently to withstand its attacks. An account of this disease has already been given in the June number of the *Malayan Agricultural Journal*, Vol. XVIII, p. 306.

In the holdings around Pekan on the east coast of Pahang, a species of cicada did some damage to rubber trees and a number of other plants during March by laying its eggs in large numbers in the tender bark of the young green shoots.

During February, when the trees were bare of leaves, it was noticed that a species of mistletoe was frequently to be found on rubber trees in Negri Sembilan and also more occasionally in Selangor. Advantage was taken of the season when it is most conspicuous to give orders for its removal.

In conclusion, reference may be made to the very interesting and instructive series of exhibits shown by the Rubber Research Institute at the Malayan Agri-Horticultural Association's Exhibition in Kuala Lumpur on April the 19th to 21st. The main points illustrated by the exhibits were Budding, Preparation of Rubber, and Diseases. Demonstrations of the technique of budding were given at intervals throughout the three days and were very well attended. Special talks about the exhibits were given in Malay on the 20th and 21st early in the morning before the Exhibition was open to the public, to the delegates of Rural Credit Co-operative Societies who were attending a Conference in Kuala Lumpur, and to parties of Malay village headmen. Leaflets in Malay on the various exhibits were distributed to those attending these special demonstrations, while supplies of the leaflets in both English and Malay were available for all members of the public.

# CULTIVATION OF WET RICE UNDER IRRIGATION IN AUSTRALIA

BY

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During a recent visit to Australia, the writer was able to visit and to inspect the Murrumbidgee Irrigation Area, New South Wales, where, during recent years, the cultivation of rice under irrigation conditions has been meeting with increasing success as is shown by the fact that whereas in the 1924—25 season the planted area was 157 acres, in 1928—29 it had increased to 14,319 acres.

The following figures show the annual increase in planted area up till 1929.

| Season. | Acres. |
|---|---|
| 1924—25 | 157 |
| 1925—26 | 1,978 |
| 1926—27 | 4,772 |
| 1927—28 | 12,080 |
| 1928—29 | 14,319 |

It is estimated that the planted area for the 1929—30 season exceeds 19,000 acres.

For the season 1927—28 with 12,080 acres under cultivation, the total yield was 19,130 tons, or the equivalent of 5,739,000 gantangs, equal to an average yield over the whole area of 457 gantangs of padi per acre. It was stated that crops up to 5 tons padi or approximately 900 gantangs rice per acre have been harvested and that a yield of 3 tons padi or approximately 540 gantangs rice is not unusual.

The 1928—29 crop had been harvested just prior to the writer's visit, so that he was only able to observe the padi in its early stages of growth.

It is claimed that rice has been grown on some of the poorest classes of land in the district with most satisfactory results. Throughout the Murrumbidgee area there is a considerable amount of heavy clay loam overlying a stiff clay sub-soil. Prior to being utilised for the cultivation of rice, this land had proved practically useless for the production of other crops, but since the establishment of padi cultivation quite remunerative crops of both wheat and oats have also been obtained from the land.

The successful cultivation of rice is dependent largely upon:—

A. High temperatures during the growing period.

B. A reliable water supply.

C. Soils that are comparatively flat.
D. Good surface drainage.
E. Freedom from water weeds.
F. Dependable seasons.

With the exception of the problem of weeds, these desiderata are fully met in the area in question. The temperature is particularly suitable, readings as high as 110°F often been reached.

## Preparation of the Land.

For the cultivation of rice, it is necessary that the land be practically level. Where this is not the case, grading is rendered essential. If the contour of the land is such as to demand heavy grading, areas result on which the top soil is lost, producing harmful effects to the crop. Instances of this were pointed out, but apparently they are rather the exception than the rule as, up to the present, sufficiently flat land has been available.

It is the practice to contruct extremely large check banks (bunds) owing to the porous quality of some of the top soil and also the rather great depth of water which it is the practice to utilise. These banks should in all cases be constructed some time previous to planting, in order that they may have sufficient time to settle and become more impervious to water. Furthermore, it is often necessary to raise these banks just prior to planting owing to the fact that they have settled considerably since construction; this operation would be most difficult and expensive if carried out after planting when the water is on the bay.

In the construction of check banks, furrows are struck out leaving an unploughed strip of 6 to 8 feet in the centre. This strip thus forms a solid foundation for the check bank. The ploughed soil is afterwards thrown in from each side with a "delver", and the process of alternately ploughing and delving continued until the bank is sufficiently high. This operation, after grading, is considered to be one of the most important and may be directly responsible for the resultant success or failure of the crop.

The size of the bays depends largely upon the contour of the land; the most convenient and easily controlled are found to be from 5 to 6 acres. Long narrow bays running in the same direction as the prevailing winds have been proved to be disadvantageous as the water often becomes so choppy as to damage severely plants in the early stages of growth.

The form of cultivation and method of sowing are very similar to those in practice for the cultivation of wheat, i.e. ploughing, cultivating, harrowing and drilling. Two exceptions worthy of note are concerned with the depth of ploughing and the method of sowing. Ploughing to a depth of only three inches is the usual practice; this is often carried out with a 12 disc cultivator having adjustable discs. In sowing, the hoes are removed from the drill thus allowing the seed to fall on the surface of the ground, the drill is then followed by harrows which cover the seed to some extent. The removal of the hoes is rendered

necessary by the fact that owing generally to the sticky nature of the soil, the hoes and connecting pipes to the drill continually become blocked and thus render the sowing very uneven.

## Sowing.

It is considered that the best time for sowing is as soon as practicable after all danger of frosts has passed, but a little time must be allowed in order that the water temperature may be slightly raised. It is imperative that sowing should be completed as early as practicable for the following reasons:

A. Early sowing enables the longer maturing varieties to be sown. These varieties are the heaviest yielders, best stoolers and require less seed per acre.

B. In order that the crop may mature and be harvested before the commencement of the rains. This is a most important point to be considered where it is necessary to get heavy machinery on the land.

On the Murrumbidgee Irrigation Area, sowing should be commenced at the end of September or early October, seed being sown at the rate of 90—110 lbs. per acre.

Immediately on completion of sowing operations, the land is well moistened with irrigation water to assist germination; this is followed after about a week by a second watering, care being taken that the soil does not in the interval become so dry as to cake, otherwise the young plants will be severely damaged. The young plants are kept irrigated in this manner until they attain a height of approximately 6 inches, after which the water is allowed to remain on the area. The depth of water is thereafter gradually increased as the plants grow until a depth of one foot of water is attained. Water is retained on the bays at this depth until the last of the grains are out of the 'milk stage'.

It has been found unnecessary to change the water in the bays during the period of growth, but frequent waterings are essential in order to keep an even water level and replace heavy losses due to evaporation, transpiration and seepage.

The operation of draining off needs care and is usually extended over a period of 4 to 5 days; this has been found essential as any sudden removal of the water results in the lodging and consequent loss of a large percentage of the crop.

In the early stages of growth, hand weeding is practised to some extent, but the difficulty of labour is greatly against this method.

## Harvesting.

Harvesting is undoubtedly the most risky operation which has to be carried out as any sudden break in the weather prohibits all use of heavy machinery. Wet conditions have been experienced during harvest with a resultant heavy loss of grain. Later plantings are generally the most seriously affected by adverse weather conditions at harvest.

Two types of machines are in use for harvesting, the "Reaper and Binder" and the "Header". Both machines should be fitted with auxiliary motors, 3½ h.p. for the binder and 7 h.p. for the header; this will lessen the dragging power required and give more efficient results.

The "Header" is proving the more satisfactory and efficient method of harvesting as, once the grain ripens, time is of vital importance. This machine turns out the grain ready for bagging in the one operation, but it is imperative that the crop should be of an even ripening otherwise a poor sample will be obtained.

When using a binder, harvesting should be commenced a week earlier, as should the crop be at all overripe, a large percentage of the grain will become beaten out and lost. The disadvantages of this machine are mainly that it is slower, the sheaves have to be stooked for at least two weeks, carted and either stacked or threshed, a considerable loss of grain occurring at each handling; furthermore, the operation of binding and threshing has been found to be more expensive.

## Weeds.

Weed growth is the most serious pest with which rice-growers have so far had to contend, for the soil and climatic conditions are such as to be eminently favourable for the growth of all water grasses, rushes and weeds. If weeds are allowed to grow unchecked they quickly take control and render the land entirely useless for the cultivation of rice or any other crop.

Over-cropping has been found to encourage the growth of weeds; therefore rotation has been adopted as a check measure, the following being one recommended—

Rice, winter fallow, wheat, short fallow, winter legume, short fallow.

The rice is sown in October and harvested in April or May. The land is then winter-fallowed and an early maturing variety of wheat sown in April or May and harvested in December. The land is then short-fallowed and a crop of winter legume sown and grazed off by sheep. The land is then ploughed in August and given a short fallow previous to sowing again with rice, in October.

For the present, shallow ploughing has been advocated in order that the weed seeds may be kept as close to the surface as possible, thus rendering control more simple.

During the short period that rice has been under cultivation in this area it has been found impossible to obtain anything like a satisfactory yield from two successive crops of rice; in every case the second crop is almost, if not completely, smothered out by excessive weed growth.

## Fertilisers.

Up to the present, fertilisers have not been applied, but it is realised that owing to the exhaustive feeding of the crop if land is to be continually cropped, some form of fertiliser will become necessary.

## Costs.

No definite figures as to cost of production are available to the writer, but it may be accepted that the cost per acre up to and including harvesting is approximately the equivalent to the present prices of one ton of padi i.e. £10—£11.

## Production.

In Australia, up to the present time, production of rice has not exceeded consumption which is estimated at 25,000 tons annually. If, however, the cultivated area increases at the present pace it will soon become necessary to obtain an outside market in order to retain a satisfactory price. The yield for 1928—29 was in the vicinity of 21,000 tons; this figure is likely to be exceeded in the coming season, as a larger area has been planted.

## Varieties.

Two varieties of rice are cultivated, both of which have been imported from California, namely "Caloro" and "Colusa".

*Caloro* is a variety developed in California which had previously been imported from Japan. It is erect and vigorous in growth, attaining a height of about three and a half feet; is a fair stooler, with fairly coarse strong stems and is not apt to lodge. This is the standard variety grown; it is known as a good yielder, does not easily shatter and appears to do well on a wide range of soils. It matures in 180—185 days.

*Calusa*. The growth is erect but not very vigorous and rather short, reaching a height of three feet only. It is an average stooler and rather inclined to lodge. It matures in 170—175 days.

The writer is indebted to the kindness of officers of the Department of Agriculture, New South Wales in permitting a visit to this irrigation area; and especially to the Agricultural Inspector of Leeton, New South Wales for supplying all the information contained in this article.

# Abstracts.

## MARKETING PROBLEMS OF COCONUT GROWERS.*

In view of the unsatisfactory state of the existing system for marketing copra in the Philippine Islands, it should be reorganised on the basis that the problems of marketing and distribution are as much the concern of the producer as of the trader.

The small holders, who supply not less than 80 per cent of the copra, are completely in the hands of the rural middlemen. Among these local dealers, it is the common practice to advance money to the growers at onerous terms, so as to leave them always more or less in debt, and then to keep forcing down the prices and undervalueing and undergrading copra to the disadvantage of the helpless debtor-planters and of the coconut industry as a whole.

The rural buyers form the first link in a chain of intermediaries through which the copra passes on its way to the consumer, with the result that the grower receives a smaller return for his labour and the consumer is forced to pay unnecessarily high prices because each middleman in turn has to receive a sufficient margin of profit.

The grading of copra for sale to the Philippine crushers is based on a range of seven ill-defined groups based on moisture percentages and ranging irregularly from 4 per cent to 19 per cent; and for the export trade, on four grades based on appearance and origin. These systems are very unsatisfactory as besides being ill-defined they leave the valuation of copra to the whim of the buyer, and furthermore, the various grades have no legal standing for contract purposes.

The growers have at present no information as to the trend of prices, but with such information they would be able to market their produce intelligently and not be so completely in the hands of the buyers who have better information. The individual planter working alone cannot successfully market his produce to the best advantage as he is too weak to influence market developments, and he cannot establish and develop his own marketing system so as to obtain the highest return possible. Further, the producer lacks the facilities and the time needed to obtain information concerning crop and market conditions.

The Philippine Legislature recently passed the Co-operative Marketing Law which provides for the organisation of a co-operative marketing association. The Bureau of Commerce and Industry has been entrusted with the functions of establishing local associations under this law.

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*** Abstract of a speech delivered before the First National Congress of Coconut Planters held at Manila on February 21st, 1930 on "Market Problems of Coconut Growers" by Cornelius Balmareda and published in Commerce and Industry Journal, Vol. VI, No. 3, March 1930.**

The benefits which will be derived from these are as follows:—

1. Copra drying centrals would be established where modern driers would produce a uniformly high grade of copra which would command higher prices.
2. The local associations would sell the copra collectively and so obtain better prices.
3. The local associations would finance the growers and approve loans on reasonable terms.
4. The local associations would obtain reliable information on crop and market conditions from headquarters for the guidance of their business.
5. Fixed uniform copra standards would be established to improve the quality of Philippine copra and facilitate trading.
6. A Copra Produce Exchange could be established at Manila to provide an outlet for copra shipments from provinces, where no local associations exist, and to absorb the surplus copra from local associations.
7. The practices and usages of the trade would be standardised for the more speedy and orderly transaction of business.
8. Assistance would be given in the development of established markets, and systematic advertising would develop new outlets for the improved products of the Association .

The proposed methods of marketing are of interest:—

### Local Auctions.

The various consignments of copra will be delivered by the producers to the local association to be arranged for inspection by the bidders. Written bids will be deposited by the prospective buyers into boxes provided for the purpose on the auction days fixed by the Association, and at a certain hour the boxes will be opened in the presence of bidders and sellers. The bids will be read and recorded and the lots sold to the highest bidder provided that the seller is satisfied with the bid. Successful bidders will be required to make a deposit and pay the balance within three days or be liable to demurrage. Should a bidder later refuse to take delivery he will forfeit his deposit.

The expenses of the auction will be shared pro rata by members, and non-members will be charged at a fixed rate per picul sold. Every seller will guarantee his consignment as of correct weight and define its quality. A penalty will be imposed for faulty declaration.

### Central Copra Exchange.

This would make possible the meeting of big buyers and sellers at regular intervals; it would regulate the consumption of stocks and tend to stabilise prices. This proposal could later be extended to deal with other major crops and such a Produce Exchange would then be in constant activity.

The Exchange will afford a means whereby grading can be originated for the information of local associations. The existing absence of organised grading offers no inducement towards the production of high quality copra. On the contrary, it is not in the grower's interest at present to make additional effort to improve his copra as the price will remain unaltered.

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## REPORTS OF THE IMPERIAL ECONOMIC COMMITTEE. FOURTEENTH REPORT.

## A SURVEY OF THE TRADE IN RUBBER MANUFACTURED GOODS.

This Report, which is published by His Majesty's Stationery Office, London, (Price 6d. Net), consists of 119 pages, and is divided into thirty chapters and seven appendices.

The Imperial Economic Committee was appointed by the Governments of the United Kingdom, the Dominions, India, and the Colonies and Protectorates acting under a Resolution of the Imperial Conference of 1926.

The Report contains a valuable survey of Empire Trade in rubber manufactured goods which is of interest to producers of raw rubber as well as to rubber manufacturers.

The Committee emphasises the difficulties experienced in presenting comparisons of statistics of production owing to the rapidity of advance of the industry and the lack of satisfactory statistics of production of rubber goods in certain countries.

As the Committee states, the rubber manufacturing industry is frequently considered to be synonymous with the tyre industry, but this is only justified by the fact that 75 per cent of the raw rubber produced is absorbed in the manufacture of tyres.

### Varieties of Rubber Articles.

Rubber is, however, used in the manufacture of many different articles which cannot be classified as rubber goods, including the following articles:—

(1) Tyres (solid and pneumatic) and tubes.

(2) Mechanical goods—belting, hose, tubing, valves, washers and packing.

(3) Footwear—boots, shoes, soles and heels.

(4) Miscellaneous:—Water proofed goods—apparel and fabric. Surgical and hygienic—surgeons' and other gloves, syringes, douches, hot water bottles, sponges, water and air beds. Sports goods—golf, tennis and football and bathing caps.
Toys—balls, dolls, models, aquatic toys and balloons.
Rubber thread for elastic webbing.

Stationery—rubber bands and erasers.

Hard rubber goods (vulcanite or ebonite)—for electrical apparatus, telephones, switchboards and wireless, fountain pens and parts of surgical and hygienic appliances, such as nozzles, stoppers and handles.

Electrical insulation—cables and wires.

Noise and vibration insulation—shock absorbers on railway and motor vehicles, aeroplanes, road surfaces.

Floor covering and matting—in buildings, cars, ships and aeroplanes.

Decorative purposes—artificial flowers, ornaments.

The Committee refers in a later section to comparatively recently evolved types of manufactured rubber articles, viz. hard rubber linings for containers for chemicals and soft rubber linings for grinding apparatus and mining machinery.

In some of the above articles, e.g. tyres and tubes, rubber forms a large proportion of the article; while in others, e.g. water-proofed fabrics, the amount of rubber is small.

On this account, it was found essential to deal with the trade statistics in sections. Another important consideration is that the rubber industry depends to a great extent on other industries.

## The Tyre Industry.

Tyre manufacture in countries in which the motor car industry is rapidly extending have an advantage over those in which progress is not so rapid. This is particularly noticeable in America, which during 1926—1928 possessed more than 78 per cent of the registered motor vehicles in the world, while the American share in the production of such vehicles during this period averages about 83 per cent of the world's production.

Another important point which is emphasised in relation to tyre production is that large scale units are required for economic production, so that the number of firms competing for world trade is few and international in character.

Competition in international trade in tyres is between seven large companies, one British, one French and five American. A number of factors, including tariffs, affect the flow of imports and exports from the different countries.

The organisation required for the sale of other kinds of rubber goods, which are sold to other industries, differs considerably from that required by tyre manufacturers owing to the numerous factors involved. On this account, the growth of the rubber producing industry and the absorption of raw rubber by industry in the chief manufacturing companies affords the only means of of measuring the progress of the industry as a whole.

## History of Rubber Production.

The rubber manufacturing industry was a comparatively unimportant industry until the development of cycling and motoring in 1900. In that year,

the total world's supply of raw rubber was about 40,000 tons and included only 4 tons of plantation rubber, whereas in 1928, the production of plantation rubber was over 600,000 tons and the production of wild rubber had fallen to less than 30,000 tons. In 1929, the figures are respectively about 835,000 tons and 25,000 tons.

Of the amount consumed, the United States used over 58 per cent in 1929, while the United Kingdom is a bad second at approximately 9 per cent. About 96 per cent of crude rubber is absorbed by the industries of 10 countries.

### Uses of Rubber in Different Branches of the Industry.

Raw rubber is absorbed in the various branches of industry in very different proportions in different countries, but figures based on manufacturers' returns are only available for the United States. In the United Kingdom, it is estimated that 75 per cent of raw rubber is absorbed by the tyre industry and the remainder is equally divided between mechanical goods; waterproof garments and footwear; sports, surgical and hard rubber goods; insulation of wires and cables and elastic for the textile industry.

In 1928, figures published for the United States show that more than 85 per cent of the rubber absorbed in the industry is used in the manufacture of tyres and tubes.

### Reclaimed Rubber.

The production and use of reclaimed rubber is most extensive in the United States.

In 1928, 150,000 tons of reclaimed rubber were used in addition to 440,000 tons of raw rubber. Reclaimed rubber is absorbed largely in the manufacture of hose and packing, matting, footwear and hard rubber goods. Apart from being economical in price it is considered more suitable than raw rubber for certain purposes.

### Mechanical Rubber Goods.

Next, but a poor second to the tyre industry, is the manufacture of mechanical rubber goods—which include driving belts, hose, valves, packing, various shock absorbers and other rubber goods used in connection with machinery.

Nearly 80 per cent of belting in international trade is exported by four countries of which the United States is the chief exporter and the United Kingdom the second. In belting and hose combined—the only two sections of mechanical goods for which comparable trade statistics are available—the United States and the United Kingdom occupy respectively first and second places.

### Rubber Footwear.

The rubber footwear industry is the third largest absorber of raw rubber, The chief producing countries are the United States, Canada, France and the

United Kingdom, while it is of interest to note that Japan and British Malaya compete largely in the Far East for the cheaper kinds.

In connection with rubber soles and heels, however, the centres of the manufacturing industry are not confined to a few countries. This is probably due to the comparatively small amount of skill and the comparatively low cost of machinery required for production.

## The Industry in Different Countries.

Although it is not possible in a short review to give many details, it is of interest to note the rapid advance in the consumption of raw rubber in the United Kingdom from 29,000 tons in 1923 to 72,000 tons in 1929. The position of Canada as the fifth rubber manufacturing country in the world is also of interest.

Rapid increases in production of rubber goods are also taking place in France, Germany, Japan and Belgium.

The Committee, however, emphasises the need for more uniform statistics for a proper appreciation of the economic changes and possibilities in the Empire.

## Technical Skill and Labour.

## Standardisation.

The difficulties involved in the treatment of rubber and the necessity of research into the fundamental principles on which such treatment depends is emphasised.

It is only during the last 20 years, as the reviewer of this article pointed out in 1913, that the rubber industry has changed from traditional rule of thumb methods to scientific control.

Much of the labour required in a rubber manufactory is skilled and labour charges therefore figure largely in production costs of even the most up-to-date factories—a point which is frequently overlooked by those who clamour for new uses.

Another important problem, especially in the manufacture of tyres, is that of standardisation. Although considerable advances have been made, it must be realised that car manufacturers frequently alter their designs and the tyre manufacturer is therefore dependent on these changes, since old types of tyres have to be supplied for a long time for cars already in use. This necessitates the maintenance of a large number of types of moulds, e.g. over 150 different types are required to meet demands in the United Kingdom. In the case of general rubber goods, standardisation has been prevented by the demands of the purchasers and also the conservation of the old established firms making such goods. This lack of standardisation results in uneconomical methods of production.

Three very interesting examples of this are given, viz.

(i) The demand of every marine engineer for a different colour of the rubber used in packing the joints of engines.

(ii) The manufacture of 50 different sizes of belts for driving motor cars, all within about 1 millimetre of each other in size and with little difference in shape.

(iii) The number of varieties of rubber boots and shoes of four firms in the United States amounts to 77,000.

It is, however, not possible to generalise on standardisation, since (1) the rubber manufacturing industry is catering for other trades: (2) in the manufacture of finished articles (footwear, sports goods etc.) brands and trade names have been established: (3) production of cables and elastic thread in which the rubber forms only a portion of another article.

There is, however, a distinct move towards greater standardisation, which is being supported also by the industries using the particular article and which is resulting also in the production of an article of better quality.

It is also hoped, through the efforts now being made, that all Government supplies in the United Kingdom will be based on agreed specifications. Committees have also been formed to consider standard specifications for rubber proofing for balloon fabric, rubber flooring, ebonite for panels in wireless and electrical insulation.

In the United States the Bureau of Standards has drawn up 71 specifications in relation to rubber packing, hot water bottles, rubber cement, rubber hose, matting and floors.

The recognition of such standards and specifications throughout the Empire is considered by the Committee to be important in relation to its influence on Inter-Imperial trade. Standardisation would also lead to simplification in costing and the existence of a "hall mark" for such standards would protect customers.

The chief difficulty in fixing minimum prices for a minimum standard of quality is on account of continental competition where wages are lower and the quality of the goods is often inferior, with the result that they sell at cheaper prices.

Minimum prices for lowest quality for certain rubber goods and an international price convention are already in operation and have already proved of benefit to the industry and checked the lowering of quality resulting from excessive competition.

## Research.

The Committee remarks on the fact that a number of the larger and more progressive units of the rubber manufacturing industry maintain development sections which devote their time to the study of new materials, special factory processes and new applications and uses of rubber.

Reference is also made in this connection to the formation in 1920 of the Research Association of British Rubber Manufacturers,

## Tendencies in the Industry.

The expansion in the production and uses of rubber during the present century has been phenomenal, but the prosperity of the motor industry dominates the situation not only directly but indirectly by its effect on the price of raw rubber for other uses.

There is little doubt, as the Committee states, that stability of price of raw rubber is in the interest of both the producer and user. Efforts for closer co-operation both on the selling and manufacturing sides are desirable, although this does not apply to the tyre industry which is already concentrated in a few powerful hands.

It is considered that the concentration of factories into larger units, the the conduct of research, the distribution of information and the establishment of recognised grades and standard specifications would considerably benefit the industry.

## Appendices.

The report concludes with seven appendices, which include the following interesting sections:—

(1) The Development of the Plantation Rubber Industry.
(2) International Trade in Reclaimed and Scrap Rubber.
(3) Note on the Official Statistics.
(4) Statistical Tables.
(5) Leading Canadian Rubber Manufacturing Companies.
(6) Information re wages and hours of work of rubber workers.
(7) Research Organisations.

A more detailed study of this publication will repay all those who are interested in the rubber industry and its perusal is especially recommended to the producers of raw rubber and should help them to realise the difficulties involved in connection with new uses and applications.

B.J.E.

# Reviews.

## A Preliminary Account of Three Rice Stem Borers.

BY

H. T. PAGDEN.

*Special Bulletin; Scientific Series No. 1, Department of Agriculture, S.S. & F.M.S. 30 pp. 1 plate in colour and 7 line drawings. Federated Malay States Price 50 cents (Straits Currency) Post Free.*

The occurrence of stem borers is one of the limiting factors of importance in the production of padi. The author describes three pests: *Diatraea auricilia* Dudg., *Schoenobius incertellus* Walk., and *Sesamia inferens* Walk.; also notes are given on *Trichogramma nanum* Zehn., an insect which is found parasitic on the eggs of the above pests. In addition to the valuable data given on the life history of these pests, it is particularly interesting to note the growing attention which is being given to the study—and if necessary the breeding—of parasites in an attempt to control padi borers.

A considerable amount of work has been performed on stem borers of padi in other rice-producing countries, notably in Japan and Java, but Mr. Pagden's monograph is the first published account of such pests in Malaya. The information here recorded marks a distinct advance in our knowledge of these insects, and is a preliminary to the more complete information which is essential before effective methods of control can be put in action.

D.H.G.

## Report on the Administration of the Malayan Information Agency for the Year 1929.

*F.M.S. Federal Council Paper No. 13 of 1930.*

The Malayan Information Agency of 57 Charing Cross, London, in its Annual Report for 1929 gives a brief history of the Agency since its inception in 1910, followed by an interesting account if its activities during the year 1929.

The work of the Agency falls naturally under two headings—information and publicity. Necessarily these two duties overlap, but a perusal of the report must convince the reader that the work has been well systematised.

Space forbids of a detailed review of the methods adopted by the Agency to make Malaya more familiar to the people in the United Kingdom, but the following figures regarding the work in 1929 will indicate the diverse nature of its duties. Enquiries—(personal, by letter &c.) over one thousand; by telephone, over eight thousand; Publications—17 kinds for sale, over 1,000 sold. Agency publications brought up-to-date and many distributed. Reading Room and Library—well patronised. Exhibitions—the Agency took part in five major

exhibitions and gave assistance at numerous minor exhibitions. Malayan films were shewn at the Imperial Institute Cinema and the North-East Coast Exhibition Cinema at Newcastle. Malaya was advertised in the Press. In addition, contribution of articles to the Press numbered 390. The large collection of lantern slides was revised and re-classified. These slides are available to lecturers. During the year 341 lectures were given with the aid of Agency slides.

The work of the Agency in 1929 towards promoting the agricultural prosperity of Malaya has been noteworthy. In addition to rubber, the pineapple industry in particular has been singled out for special propaganda. At the five big exhibitions in the United Kingdom the use of Malayan pineapples was popularised by attractive exhibits, by demonstrations of cooking and by the sale of a booklet on Pineapple Cookery Recipes. The increase in consumption of Malayan pineapples—from 46,000 tons in 1928 to 56,000 tons in 1929 must be due—at least in part—to the successful efforts of the Agency.

Necessarily, it is difficult to gauge the usefulness of the work performed by the Agency. Yearly, the demands of the Public on the time and resources of the Agency increase, which indicates that the information at the command of the Agency and the assistance they give is receiving ever wider recognition.

D.H.G.

## Annual Report of the Department of Agriculture, Straits Settlements and Federated Malay States, for the year 1929.

BY

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*Supplement to the F.M.S. Government Gazette, June 6, 1930, pp. 19, Price 25 cents (Straits Settlements Currency), Government Printing Press, Kuala Lumpur.*

This report comprises a concise general review of agricultural conditions in Malaya during 1929 followed by a summarised account of the principal activities of the Department of Agriculture during the same period.

In form it differs somewhat from its predecessors in that the two subjects are treated separately, Part I of the report giving a description of agricultural conditions in Malaya and Part II an account of the work of the Department including summaries of the reports of the various divisional officers.

It is necessarily difficult in the compass of nineteen pages to do more than give a broad outline of the numerous subjects treated and to indicate the lines along which the work is organised. This is especially the case in view of the considerable extensions which are at present taking place in the activities of the Department. In these circumstances it has been arranged to issue the detailed reports of heads of divisions in bulletin form.

Those who desire to obtain a concise conspectus of the position will, however, find the report to be of considerable utility. Copies can be obtained from the F.M.S. Government Printer on application, price 25 cents.

D.H.G.

# Miscellaneous.

## AGRICULTURAL SHOWS IN JULY, 1930.

### Kedah State Show.

The Kedah Agricultural Show was held in the English School, Alor Star, Kedah on July 10th and 11th, 1930. Competition in the Fruit Section was poor, but in all the other agricultural classes it was keen. Generally the classes were fully representative of the best in the various districts of the State.

Kedah contains many village industries; classes were provided for all of these and were well supported. The Kedah Government rightly considers that the encouragement of village industries is of great importance in connection with native agriculture. The Show demonstrated the growing improvement in workmanship and in particular, that the workers pay more attention than formerly to the question of utility of the objects they make.

The Department of Agriculture, S.S. & F.M.S., staged an exhibit, further particulars of which will be found under "Departmental Notes" in this issue.

The usefulness of this Show for demonstration purposes is undoubted. Large numbers of Malays congregated at the show from all districts in Kedah, giving them an opportunity of comparing their own agriculture with that of other parts of the State, and also giving the Department of Agriculture a unique opportunity for educational work, and also of getting into closer personal touch with the cultivators.

### Agricultural Show, Seremban, Negri Sembilan.

The Seremban branch of the Malayan Agri-Horticultural Association held a Show in Seremban on July 25th and 26th in the King George V school and grounds. The quantity and quality of the agricultural exhibits was satisfactory there being a good collection of fruit, vegetables and padi. In the cereals section the number of classes scheduled for padi was large, an attempt being made to provide a class for each of the principal strains grown in the Negri Sembilan. The large number of classes caused some confusion in entering exhibits and it appeared that on future occasions the number of classes could with advantage be reduced.

The poultry section was well supported and contained some good local fowls of mixed breed. School produce included good exhibits of vegetables from school gardens, some of which were derived from planting material originally distributed from the Government Experimental Plantation, Serdang. There was also a good display of basketry in this section.

The Horticultural Section was disappointing on account of the small number of exhibits though the quality of certain exhibits—such as the ferns—was good. It has been noticed in the past at different shows that this section does not receive the support it deserves, while gardeners seem too prone to undervalue the quality

of their own plants and to assume that they are not up to the necessary standard for exhibition.

Departmental displays were staged by the Infant Welfare Branch of the Medical Department, by the Forest Department, the Rubber Research Institute and the Department of Agriculture. The Co-operative Department's film for encouraging thrift was screened during the afternoon of July 25th.

The Rubber Research Institute's exhibits dealt with the subjects of rubber diseases and of methods and faults in the preparation of rubber.

Oil palm cultivation was an important feature of the display of the Department of Agriculture, which included also exhibits of pure strains of high yielding padi and of certain pests of padi, faults in the preparation of copra, certain pests and diseases of coconuts, samples of tea from the Government Experimental Plantation at Serdang, and an exhibit advocating the destruction of rats and illustrating the two principal methods in use. Departmental publications in English, Malay and Chinese were also obtainable.

The Show was fairly well attended, there being a good gathering of Malays who displayed much interest in the instructional exhibits provided by the Rubber Research Institute and the Government Departments.

## Agri-Horticultural Show, Malacca.

A Show was held by the Malacca Branch of Malayan Agri-Horticultural Association on the 26th July on the grounds of St. Francis Institution, Malacca.

The Agricultural Sections in general were very disappointing, exhibits being comparatively few in quantity and of only moderate quality. Owing to the slump in the price of rubber, many Malays could not afford either to attend the Show or to send exhibits; others again may have been deterred from supporting it by the decision of the Committee not to give free entrance passes to exhibitors and their families; while the fact that the fruit season was drawing to a close probably had some effect on the quantity and quality of the exhibits in this section.

In the School Garden class, Penkalan Balak school won the first prize for a large collection of vegetables of very fair quality grown in the school garden.

The Horticultural Section was one of the most attractive features of the Show, exhibits were good and numerous in most classes though the most outstanding were those in which a truly remarkable number of flowering orchids were displayed. There was keen competition also in the class for table decorations.

Adjoining the Horticultural Section were instructional exhibits prepared by the Forests Department and jointly by the Rubber Research Institute and the Department of Agriculture. The points illustrated by the latter exhibit were notifiable diseases of rubber, faults in the preparation of rubber, faults in the preparation of copra, certain pests and diseases of coconuts, improved strains of padi, stem borers and other pests of padi, rat destruction, and tea from the Government Experimental Plantations at Serdang and Cameron's Highlands.

# FROM THE DISTRICTS.

## The Weather.

The month of July throughout the country was dry and hot with occasional local showers.

## Remarks on Crops.

*Rubber.*—There was a further slight fall in the price of rubber during the month. Smoked sheets from small holdings sold for 17 to 20 cents a kati and unsmoked sheet for 15 to 19 cents. The various effects of the low price mentioned in these notes for the month of June were even more noticeable during July.

*Padi.*—While the water supply in Penang has been adequate and preparation of the land for the next padi crop is progressing normally, clearing and cultivation have been delayed by drought in Province Wellesley and also in parts of Negri Sembilan and Pahang. In Krian District, nurseries were planted in the mukims which obtained irrigation water, but the drought again rendered it necessary to cut off the water from the three southern mukims of Briah, Gunong Semanggol and Selinsing as was done last year, so that in consequence little work has been done. In other parts of Perak, in Selangor, Rembau District of Negri Sembilan and in Malacca, cultivation of the land was nearing completion and in some localities transplanting from the nurseries was in progress. In the river mukims of Western Pahang it now seems certain that possibly as much as 25% of the total plantable area of wet padi land will have to lie fallow during the present season owing to an entire lack of water. Shortage of seed is likely to limit the area that can be planted with dry padi in this part of Pahang.

*Coconuts.*—The price of copra was \$6.50 to \$6.90 per pikul in Province Wellesley and Krian and from \$5.50 to \$6.75 per picul in Selangor. In the west coast districts nuts sold for 2 to 3 cents each while inland the price varied between 4 and 8 cents each in the villages. Market prices are usually from 2 to 3 cents a nut higher.

There have been heavy crops of nuts in Province Wellesley. In Selangor, owing to the low price to copra, small holders are beginning to manufacture their own copra instead of selling their nuts to Chinese copra dealers.

*Coffee.*—The price of coffee beans in Selangor has varied around \$19.21 per pikul. An area of 150 acres of coffee has been planted in Port Dickson District and a further area of 100 acres has been prepared for planting. There was a severe outbreak of coffee berry borer, *Stephanoderes hampei* Ferr., on an area of 30 acres of Liberian coffee in Western Pahang. Advice was given for the control of this pest.

*Areca Nuts.*—A market was found in Singapore for a first consignment of 10 pikuls of dried betel-nut prepared by Malays of Budu in Kuala Lipis District. The price quoted was $8.60 per pikul. The purchasing firm kindly gave advice whereby the quality of future consignments could be improved. It is hoped that the attempt by these Pahang Malays to start a local betel-nut industry may be encouraged by the help given.

*Pineapples.*—The main crop has now been received and canned by the Singapore factories, though considerable quantities of fruit are still being received at intervals. Prices have improved slightly now that the main crop has been harvested.

*Fruit.*—Further supplies of local fruits ripened during the month. Rambutans and durians were plentiful in Penang, prices being from 40 to 90 cents a hundred for rambutans and 20 cents each for durians. The Selangor and Negri Sembilan crops varied in different districts both in quantity and quality, but on the whole were light. Prices varied greatly. At the beginning to the season, durians in Negri Sembilan were selling for 25 to 60 cents each and later for 10 to 35 cents each, while in Kuala Langat they could be brought at 4 cents each. Mangosteens sold for 40 to 90 cents a hundred in different districts. In Negri Sembilan the price of rambutans ranged from 15 cents to as much as $1 a hundred for the best varieties.

In Pahang West the fruit crop was satisfactory. The Malays in Raub District who subscribed to purchase stocks of fruit trees have been supplied with 241 young trees of various kinds and have been given brief instructions for planting them.

*Rotan Sega.*—In 1916, a Malay in Lower Perak District planted this rotan—which is the variety used in making cane chairs of the best quality—on a swampy portion of his land. The crop was sold in 1923 for $600, a yield of 150 pikuls being obtained from 4 acres. The land was replanted and the rotan is now mature. The owner has been advised to harvest and sell it himself and not to sell it "on the land" as he did on the first occasion.

## Notes on Demonstration Stations and Padi Test Plots.

*Kuala Kangsar Demonstration Station.*—The plots set aside for short term vegetables were prepared and a supply of seed from Australia arrived. This will be sown when the drought breaks.

Chickens were continuously being hatched in small numbers in the incubators. Both fowls and ducks remained healthy. Sixty-three duck eggs were sold.

*Pulau Gadong Padi Experiment Station, Malacca.*—The manurial plots were all planted together with some of the longer period strains of padi in the variety trials. Preparation of the remainder of the land was completed for planting early in the coming month.

*Lenggong Padi Test Plot, Upper Perak.*—A very conveniently situated piece of land has been obtained on lease and has been suitably laid out.

*Kuang and Kajang Padi Test Plots, Selangor.*—Transplanting from the nurseries was completed on both plots. The Kuang plot had a sufficient supply of water and was in good condition, but trouble was experienced with the dam controlling the water supply to the Kajang plot.

*Jelebu Padi Test Plot.*—Transplanting from the nurseries was completed during the month.

*Temerloh Padi Test Plot, Pahang.*—Transplanting was completed. The water supply was well maintained and all varieties made good growth.

*Alor Gajah Padi Test Plot, Malacca.*—A suitable piece of land on the road-side at the entrance to Alor Gajah village has been leased and prepared for planting.

## Plant Distribution.

Arrangements were made for the distribution of considerable quantities of pedigree strains of padi to cultivators in the District of Larut and Matang.

Other plants distributed included lime trees and carpet grass from the Seremban Station, banana suckers from the Kuala Lipis Station, and, to school gardens and Chinese market gardeners, Greater and Lesser Yams, Ginger, seed of different varieties of maize and seed of Sorghum from the Experimental Plantation, Serdang, together with purchased vegetable seeds.

## School Gardens.

While there is still room for improvement in some gardens, others show very satisfactory progress as a result of the regular visits now paid to them in all districts by officers of the Field Branch of this Department.

## Locusts.

No locusts either in the flying or hopping stage have been found for over two weeks in the areas in Negri Sembilan where they occurred previously; none have been found elsewhere.

## Rats.

In Province Wellesley rewards were paid for 149,358 rats' tails and 22,758 poison balls were distributed. Organised rat drives were carried out by the Malays in the process of clearing their land for padi planting.

In Krian tails collected amounted to 228,655 during the month. This is the highest total yet obtained in a single month. In addition 20,557 poison balls were distributed.

Padi Inspectors everywhere are impressing on padi growers the need for taking continuous action to keep down rats. A leaflet in Malay on this subject has been printed and sent out to the Agricultural Field Officers for free distribution. A considerable number of rat traps have been sold at cost price in many parts of the country and there is a good demand for more. A further stock of poison is being obtained for use in different parts of Perak.

# DEPARTMENTAL NOTES.

### The Director of Agriculture visits Penang, Province Wellesley and Kedah.

The Director of Agriculture visited Penang and Province Wellesley between July 6th and 10th. On the 11th he proceeded to Kedah for the purpose of attending the Agricultural Show at Alor Star. While in Penang and Province Wellesley he inspected the proposed sites for the new demonstration and test plots.

### Discussions Regarding Jelutong.

Major Georgi, acting Agricultural Chemist, has concluded a visit to New York which was undertaken principally with the object of discussing with manufacturers problems concerning the preparation of jelutong, methods of analysis and condition of the product. After interviewing all New York firms interested in jelutong he was able to effect an agreement between them on the subject of a standardised procedure for sampling and analysing jelutong.* This may be regarded as an important result of his visit. A well-known New York jelutong firm commenting on this agreement in a recent letter stated:

> "The method is absolutely fair to both the Buyer and Seller and is bound to benefit the entire Jelutong Industry. Even if nothing else had been accomplished, we feel that Major Georgi's trip has been well repaid by the universal adoption of the above method."

Many of the discussions in New York were of a highly technical nature concerning the preparation and marketing of this material. The chief points considered were the coagulation of jelutong latex, including method of collection; refining of jelutong, including the use of preservatives; oxidation of material, including the inspection of consignments of different brands; sampling of material and determination of moisture; general considerations, including the comparison of jelutong from the Federated Malay States and Sarawak.

### Departmental Exhibits at Agricultural Shows.

As will be noted in the brief accounts on another page, the Department of Agriculture staged departmental exhibits of an educational nature at the Agricultural Shows held in July at Alor Star, Seremban and Malacca. The Department is grateful to the respective Show Committees for the facilities given in this connection. The following particulars of the Departmental exhibit at Alor Star, Kedah, is typical of the participation of the Department at District Agricultural Shows this year.

* The procedure is based on an article on this subject which was published in the Malayan Agricultural Journal Vol. XVII, No. 6, 1928.

The display at Alor Star occupied a space of 30 feet by 3 feet. The display was arranged in sections as follows:—Selected strains of padi; rat destruction methods; copra and coconuts; tapioca, gaplek; pests of padi and coconuts; coconut diseases.

The padi and rice exhibits showed the advantages to be derived from planting selected seed suited to particular conditions, while the rat destruction section illustrated the best means of controlling rats by traps and poisoned baits.

The copra samples showed the common defects in the locally prepared product and explained how these could be avoided; which the coconuts in different stages of ripeness, namely ripe, underripe and overripe, indicated how the maximum amount of good copra could be obtained by picking only nuts that were fully ripe.

Tapioca roots were shown together with sliced and dried roots, known in commerce as "Gaplek". It was demonstrated that gaplek meal could be used, mixed with wheat flour, in the manufacture of bread, biscuits, scones and fancy cakes, samples of which were shown as prepared by the Central Bakery and Confectionery Co., Kuala Lumpur.

The entomological exhibits consisted of mounted specimens of the chief pests of padi and coconuts in different stages of development, whilst the section devoted to coconut diseases showed the damage done by a species of Marasmius on the leaf bases of the palm, and other exhibits the effect of lightning strike.

All the exhibits were suitably labelled in Jawi as well as in English, and a large number of instructive leaflets, also in Jawi, were distributed.

The different publications of the Department were advertised and copies of each were displayed for sale and distribution.

It is proposed to stage departmental exhibits of a nature suitable for the various districts at the forthcoming agricultural shows at Kuantan and Temerloh, Pahang.

## Demonstration to Chinese at the Government Experimental Plantation, Serdang.

On July 15th, a party of Chinese gentlemen from Kuala Lumpur attended a demonstration at the Government Experimental Plantation, Serdang.

The tea and oil palm factories were inspected and the various processes of manufacture explained. The stock farm was also visited where the Middle White pigs, as usual, attracted general attention. After an inspection of the fruit and tea nurseries, the party proceeded to the fields. Unfortunately rain curtailed the visit.

Notwithstanding the premature and uncomfortable termination of the demonstrations, the party expressed itself as being very satisfied with the visit.

## Transfer of Mr. W. N. Sands to Kedah.

Mr. W. N. Sands, Assistant Economic Botanist on reaching the age limit was due for retirement from this service on 21st July, 1930. The Secretary of

State for the Colonies has approved that the term of service of Mr. Sands be extended for a period not exceeding two years in order that he may be seconded for special service under the Government of Kedah. Mr. Sands proceeded to Kedah on transfer on July 21st.

Mr. Sand's experience of agriculture and especially of problems connected with rice-growing will prove invaluable in laying the foundation of an efficient Agricultural Department in the State of Kedah.

## COMMITTEE FOR THE EXTENSION OF THE CULTIVATION OF RICE IN MALAYA.

The Governor has recently appointed a Committee for the purpose of enquiring into measures which can be taken to extend the cultivation of Rice in the Peninsula. The personnel of the Committee is as follows: The Director of Agriculture, Chairman; The Hon'ble Mr. A. Caldecott, British Resident, Negri Sembilan; The Hon'ble Mr. A. S. Haynes, British Adviser, Kelantan; The Hon'ble Mr. Tan Cheng Lock; The Hon'ble The Undang of Rembau; Mr. C. N. Maxwell; and Tunku Mansur, State Secretary, Kedah.

The first meeting of the Committee will be held on August 8th.

The appointment by His Excellency the High Commissioner of a Committee to investigate and report on measures to be taken to secure the extension of rice cultivation in the Peninsula is a step of considerable importance; from time to time in this Journal reference has been made to the need for attention to the question of decreasing the dependence of Malaya on imported food-stuffs; while in the April issue special notice was called thereto in the message which His Excellency addressed to the readers of this Journal.

The appointment of the Committee represents a first step towards the solution of this important and difficult question.

It is hoped that the report of the Committee may be forthcoming within the next few months and that as a result, practical recommendations may be arrived at which will tend to bring about an extension both in the area cultivated and in the yield of this staple.

# MARKET PRICES.

## July, 1930.

*Rubber.*—The average price of rubber in Singapore for the month was 17.97 cents per lb. The highest price recorded was on July 1st when it was 20 cents per lb; the lowest price recorded being at the end of the month, when it stood at $16\frac{3}{8}$ cents per lb. The average London price for July was 5.66 pence per lb., the highest price being $6\,{}^3/_{16}$d. the lowest $5\,{}^3/_{16}$d. per lb. The average prices in June were 25.55 cents Singapore and 6.15d. London.

*Copra.*—The price of copra has remained at about the closing price in June. Singapore average prices in July were $\$7.39\frac{1}{2}$ per picul F.M. quality; $\$7.77\frac{1}{2}$ per picul S.D. quality. Corresponding prices for the previous month were F.M. $7.94, S.D. $8.38.

*Gambier.*—The Singapore gambier market was slightly stronger than in June. Average prices per picul were, for Block Gambier $\$8.22\frac{1}{2}$; Cube $15.55. Corresponding averages for the previous month were $8.04 and $15.31.

*Nutmegs.*—Nutmeg prices were steadier during the month. Singapore average prices were for 110 per lb.; $30.60 per picul compared with $28.25 in June; 80 per lb, $34.60 compared with $35.25 per picul in June.

*Pepper.*—Pepper prices have declined sharply. Black pepper, quoted at $\$34\frac{3}{4}/30$ at the end of June declining to $25/24 a month later; White pepper $44.75/41 in June declining to $36/34 in July. The average Singapore prices for the month were Black $\$27.62\frac{1}{2}$; White $\$39.62\frac{1}{2}$ per picul compared with $\$37.37\frac{1}{2}$ and $51.56 for June.

*Rice.*—Singapore average prices for July: Siam $363; Saigon, white $254; Rangoon, white $222;—all per coyan. Corresponding prices for June were $370; $261; $244.

*Sago.*—This product further declined on the Singapore market. Average prices for July were as follows:—Pearl, fair $\$5.82\frac{1}{2}$ per picul compared with $3.32 in June.

*Tapioca.*—Flake, small, fair; stronger, the Singapore average prices in July being $\$4.28\frac{1}{2}$ per picul compared with the previous month's average of $\$4.10\frac{1}{2}$. Pearl, fair; weaker, the average price being $\$5.72\frac{1}{2}$ per picul in July compared with $6.19 in June.

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The above market prices are based on the daily cabled London quotations and the Singapore quotations for rubber; on the Singapore Chamber of Commerce Market Reports covering the period of June 23rd to July 26th and on other local sources of information.

1 coyan = 40 piculs. 1 picul = $133\frac{1}{3}$ lbs.

The dollar is fixed at two shillings and four pence.

# MALAYA RUBBER STATISTICS.

**Stocks of Rubber including Latex and Revertex held by Dealers and Estates of 100 Acres and Over, the Declared Production of the same Estates, Import and Export Figures, and Estimated Figures of the Production of Estates of Less than 100 Acres, for the Month of June 1930, in Dry Tons.**

| Territory | Stocks at beginning of month: Ports | Stocks at beginning of month: Dealers | Stocks at beginning of month: Estates of 100 acres and over | Production by estates of 100 acres and over: during the month | Production by estates of 100 acres and over: during the year 1930 | Production by estates of less than 100 acres (estimated): during the month | Production by estates of less than 100 acres (estimated): during the year 1930 | Imports during the month: Foreign | Imports during the month: From Malay States | Imports during the year 1930: Foreign | Imports during the year 1930: From Malay States | Exports (including re-exports) during the month: Foreign | Exports during the month: Local | Exports during the year 1930: Foreign | Exports during the year 1930: Local | Stocks at end of month: Dealers | Stocks at end of month: Estates of 100 acres and over | Stocks at end of month: Ports |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **Malay States** | | | | | | | | | | | | | | | | | | |
| **Federated Malay States** ... ... | ... | 8,726 | 6,441 | 12,175 | 60,603 | 7,748 | 54,985 | Nil | Nil | Nil | 37 | 9,817 | 3,378 | 89,178 | 31,266 | 8,551 | 13,344 | ... |
| **Johore** ... ... | ... | 2,216 | 3,404 | 3,842 | 18,908 | 3,297 | 23,628 | Nil | 2 | Nil | 9 | 583 | 5,183 | 5,665 | 37,832 | 2,297 | 4,698 | ... |
| **Kedah** ... ... | ... | 400 | 935 | 2,163 | 10,218 | 993 | 7,476 | Nil | Nil | 2 | Nil | 291 | 1,729 | 3,868 | 14,106 | 325 | 2,146 | ... |
| **Perlis** ... ... | ... | 10 | 10 | 8 | 50 | 16 | 88 | Nil | Nil | Nil | Nil | Nil | 23 | Nil | 149 | 11 | 10 | ... |
| **Kelantan** ... ... | ... | 180 | 110 | 112 | 1,503 | 82 | 2,133 | 4 | Nil | 22 | Nil | 9 | 317 | 357 | 3,498 | 111 | 51 | ... |
| **Trengganu*** ... | ... | 55 | 50 | 70 | 696 | 37 | 348 | Nil | Nil | Nil | Nil | Nil | 107 | Nil | 1,045 | 55 | 50 | ... |
| **Straits Settlements** | | | | | | | | | | | | | | | | | | |
| **Malacca** ... ... | ... | 2,161 | 1,063 | 1,254 | 6,501 | | | Nil | 1,708 | Nil | 8,663 | 3,387 | | 22,314 | | 2,082 | 1,601 | ... |
| **Province Wellesley** | ... | 89 | 228 | 280 | 2,248 | 3,124† (Straits Settlements) | 18,583 (Straits Settlements) | | | | | | | | | 92 | 571 | ... |
| **Dindings** ... ... | ... | 123 | 102 | 98 | 525 | | | 660 | 2,460 | 4,930 | 19,244 | 4,329 | Nil (Straits Settlements) | 33,372 | Nil (Straits Settlements) | 57 | 143 | ... |
| **Penang** ... ... | 716 | 5,086 | 14 | 10 | 59 | | | | | | | | | | | 4,322 | 16 | 1,398 |
| **Singapore** ... ... | 3,049 | 32,402 | 270 | 283 | 1,303 | | | 9,128 | 6,567 | 57,608 | 59,947 | 19,196 | | 124,574 | | 30,448 | 368 | 2,865 |

**Analysis of Colony and Federated Malay States Dealers' Stocks at End of Month, in Dry Tons.**

| Class of Rubber | Federated Malay States | Singapore | Penang | Province Wellesley, Dindings and Malacca | Johore | Gross total |
|---|---|---|---|---|---|---|
| (20) | (21) | (22) | (23) | (24) | (25) | (26) |
| Smoked sheet ... | 6,015 | 13,267 | 2,712 | 1,166 | 951 | 24,111 |
| Crepe ... ... | 677 | 14,924 | 808 | 659 | 350 | 17,418 |
| Unsmoked sheet ... | 840 | 2,257 (Unsmoked sheet and Scrap and lump) | 802 (Unsmoked sheet and Scrap and lump) | 406 (Unsmoked sheet and Scrap and lump) | 566 | 6,320 (Unsmoked sheet and Scrap and lump) |
| Scrap and lump ... | 1,019 | | | | 430 | |
| Total all Grades ... | 8,551 | 30,448 | 4,322 | 2,231 | 2,297 | 47,849 |

*Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated July 9. The ratio of the reduction on wet rubber is taken to be 25% applicable to wet stocks at the ports of Singapore and Penang.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I. & E. 5, dated July 3, reduced to dry weight by the percentage for June in Note 3; (*S.S. Gazette* Notification No. 1890/1930).

6. Foreign exports of each State and Settlement are those published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I and E. 4, dated July 2, (Appendix IV to Monthly Trade Return).

*7. Stocks and production in Trengganu are estimated from figures supplied by the Commissioner of Lands.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.

†9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the Columns composing it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

J. I. Miller, M.C.S.,
*Acting Registrar-General of Statistics, S.S. and F.M.S.*

Singapore, July 18, 1930.

# SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS, FOR THE MONTH OF JUNE, 1930.

## NEW SEASON COMMENCING.

| State Settlement. (1) | District Mukims (2) | Acreage of Padi Land Acres (3) | Acreage planted Acres (4) | Percentage 4 to 3 (5) | Gross Crop Gantangs (6) | Crop per Acre 6 to 4 (7) | Remarks (8) |
|---|---|---|---|---|---|---|---|
| **Straits Settlements** | Malacca, (C. Dist.) | 21,658 | ... | ... | ... | ... | Nurseries sown in most of the areas. Preparation of land in progress. Shortage of water has delayed over half the area in Jasin and A. Gajah Districts, but it is not late enough for crops to be necessarily affected. |
| | Alor Gajah ,, | 11,412 | ... | ... | ... | ... | |
| | Jasin ,, | 2,229 | ... | ... | ... | ... | |
| | Total :— | 35,299 | ... | ... | ... | ... | |
| | P. Wellesley (North) | 25,000 | ... | ... | ... | ... | Clearing and ploughing should have been commenced in all Districts except P. Wellesley South. What little have been done is held up by lack of sufficient water. Few nurseries in course of preparation. **Scattered Areas:**—500 acres. **Areas, Dry Padi:**—350 acres. |
| | (Central) | 10,240 | ... | ... | ... | ... | |
| | (South) | 4,400 | ... | ... | ... | ... | |
| | Total :— | 39,640 | ... | ... | ... | ... | |
| | Penang | 4,000 | ... | ... | ... | ... | Clearing commenced. |
| | Singapore | ... | ... | ... | ... | ... | Nil. |
| | Total S.S. | 78,939 | ... | ... | ... | ... | |
| **Perak (N)** | Krian District | 53,250 | ... | ... | ... | ... | Work commencing. |
| | Larut and Selama | 11,975 | ... | ... | ... | ... | |
| | Kuala Kangsar | 14,482 | ... | ... | ... | ... | |
| | Upper Perak | 3,695 | ... | ... | ... | ... | |
| | Total :— | 83,402 | ... | ... | ... | ... | **Season 1930-1931:**—Acreage of padi land in Mukims of Ulu Bernam and Slim, not known yet. Nurseries sown and clearing commenced in most of the Mukims. **Season 1929-1930:**—Harvesting completed and crop harvested: Total acreage planted 3,108 acres. Total crop 650,198 gantangs. Dry Padi, 5,963 acres, Yield 916,365 gantangs. |
| | (S) Districts | 14,187 | ... | ... | ... | ... | |
| | Total Perak | 97,589 | ... | ... | ... | ... | |

## SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS, FOR THE MONTH OF JUNE, 1930.—(Continued).

| State Settlement | District Mukims | Acreage of Padi Land | Acreage planted | Percentage 4 to 3 | Gross Crop | Crop per Acre 6 to 4 | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | Gantangs | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Selangor** | Inland Districts | 4,572 | ... | ... | ... | ... | **Inland:**—Ulu Langat and Ulu Klang Districts: Nurseries sown and in some fields transplanting commenced. Kuala Lumpur and Ulu Selangor Districts work not yet commenced. |
| | Coast Districts | 18,720 | ... | ... | .. | ... | **Coast:** Except Bukit Cheraka, all other Mukims work not yet commenced. |
| | Total Selangor | 23,292 | ... | ... | ... | ... | |
| **Negri Sembilan** | Six Districts | 37,217 | ... | ... | ... | ... | Preparing fields, transplanting started only in Jelebu District. **Area Dre Padi:** 449 acres. In Port Dickson Dist. Padi being transplanted. |
| **Pahang** | West | 20,089 | ... | ... | ... | ... | Nurseries sown in most of the Mukims. Preparation of land for transplanting commenced, but shortage of water holding up operation in many areas. |
| | East | * | ... | ... | ... | ... | * **Pahang East:**—Acreage of Padi land not known yet. Last season 1 175 acres were planted and harvesting completed, but estimated crop not yet known. |

# METEOROLOGICAL SUMMARY, MALAYA. JUNE, 1930.

| Locality | Air Temperature in Degrees Fahrenheit | | | | | | | Earth Temperature | | Rainfall | | | | | | | | | Bright Sunshine | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Means of | | Mean of A and B | Absolute Extremes | | | | At 1 foot | At 4 feet | Total | | Most in a day | Number of days | | | | | | Total | Daily Mean | Per cent | Length of Day |
| | A. Max. | B. Min. | | Highest Max. | Lowest Min. | Lowest Max. | Highest Min. | | | | | Amt. | Precipitation* | Precipitation, 1mm. or more | Thunder-storm | Thunder heard | Fog morning obs. | Gale force 8 or more | | | | |
| | °F | °F | °F | °F | °F | °F | °F | °F | °F | in. | mm. | ins. | | | | | | | hr. | hr. | % | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 91.0 | 72.1 | 81.5 | 94 | 69 | 88 | 74 | 83.9 | 84.4 | 7.68 | 195.1 | 1.99 | 17 | 14 | 3 | 14 | 3 | | 193.75 | 6.46 | 53 | 12.3 |
| Bukit Jeram, Selangor ... | 89.1 | 72.7 | 80.9 | 92 | 71 | 85 | 75 | 86.0 | 87.9 | 3.11 | 79.0 | 1.46 | 15 | 9 | 2 | 17 | ... | | 219.65 | 7.32 | 59 | 12.3 |
| Sitiawan, Perak ... | 90.3 | 72.6 | 81.5 | 95 | 69 | 86 | 75 | 84.4 | 84.7 | 3.46 | 87.9 | .79 | 13 | 11 | 9 | 17 | ... | | 215.00 | 7.17 | ... | .. |
| Kroh, Perak ... | 86.8 | 69.9 | 78.3 | 93 | 67 | 82 | 72 | 81.5 | 83.8 | 6.86 | 174.3 | 1.68 | 15 | 12 | ... | 5 | ... | | 180.05 | 6.00 | ... | ... |
| Temerloh, Pahang ... | 89.6 | 72.8 | 81.1 | 93 | 69 | 83 | 75 | 84.0 | 86.1 | 7.22 | 183.4 | 3.41 | 16 | 15 | 1 | 21 | 12 | | 185.45 | 6.18 | ... | 12.3 |
| Kuala Lipis, Pahang ... | 89.5 | 71.2 | 80.3 | 92 | 69 | 85 | 73 | 83.9 | 84.0 | 12.81 | 325.4 | 2.47 | 14 | 14 | 13 | 19 | 21 | | 192.25 | 6.41 | ... | ... |
| Kuala Pahang, Pahang ... | 87.2 | 74.0 | 80.6 | 90 | 72 | 83 | 76 | 86.0 | 87.0 | 3.88 | 98.6 | 1.18 | 14 | 11 | 4 | 15 | 1 | | 210.75 | 7.03 | 57 | 12.3 |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 72.2 | 59.6 | 65.9 | 78 | 58 | 66 | 61 | ... | ... | 4.87 | 123.7 | 1.30 | 17 | 15 | 4 | 17 | 1 | | 187.70 | 6.26 | 50 | 12.4 |
| Cameron's Highlands, Tanah Rata | 72.9 | 54.9 | 63.9 | 77 | 48 | 68 | 60 | 70.4 | 70.0 | 4.65 | 118.1 | 1.05 | 18 | 15 | 4 | 17 | 5 | | 178.05 | 5.93 | 48 | 12.4 |
| Fraser's Hill, Pahang ... | 74.2 | 62.5 | 68.3 | 78 | 61 | 71 | 64 | 71.6 | 72.3 | 5.77 | 146.6 | 1.03 | 20 | 15 | 5 | 15 | 24 | | 188.50 | 6.28 | ... | 12.3 |
| Mount Faber, Singapore ... | 86.8 | 76.3 | 81.5 | 91 | 72 | 78 | 80 | 82.2 | 83.5 | 10.43 | 264.9 | 3.90 | 12 | 9 | ... | 11 | ... | | 174.65 | 5.82 | 48 | 12.2 |
| Butterworth, Province Wellesley | 88.2 | 74.3 | 81.3 | 92 | 73 | 85 | 76 | 86.6 | 84.8 | 10.69 | 271.7 | 2.55 | 15 | 13 | 1 | 7 | ... | | 212.25 | 7.07 | ... | ... |
| Bukit China, Malacca ... | 85.6 | 73.9 | 79.7 | 88 | 72 | 81 | 76 | 83.6 | 84.9 | 10.15 | 257.8 | 3.12 | 16 | 11 | ... | 5 | 1 | 1 | 213.95 | 7.13 | 58 | 12.3 |
| Kluang, Johore ... | 87.8 | 71.3 | 79.5 | 94 | 69 | 82 | 73 | 82.1 | 82.8 | 5.91 | 150.1 | 2.08 | 18 | 14 | 1 | 15 | 4 | | 157.80 | 5.26 | ... | 12.2 |
| Bukit Lalang, Mersing, Johore... | 89.2 | 72.0 | 80.6 | 92 | 70 | 85 | 74 | 82.3 | 82.6 | 6.26 | 159.0 | 1.08 | 19 | 15 | ... | 19 | 1 | | 191.25 | 6.37 | ... | 12.3 |
| Alor Star, Kedah ... | 88.6 | 73.7 | 81.1 | 93 | 71 | 85 | 76 | 86.8 | 87.4 | 5.19 | 131.84 | 1.91 | 14 | 12 | ... | 20 | ... | | 191.95 | 6.40 | ... | ... |
| Kota Bharu, Kelantan ... | 89.3 | 73.3 | 81.3 | 92 | 70 | 85 | 76 | 85.1 | 85.2 | 6.97 | 177.1 | 2.46 | 13 | 10 | 1 | 17 | ... | | 205.05 | 6.83 | ... | ... |
| Kuala Trengganu, Trengganu... | 89.7 | 73.2 | 81.5 | 92 | 71 | 84 | 76 | 84.7 | 85.7 | 5.40 | 137.2 | 2.45 | 7 | 6 | 8 | 8 | 1 | | 228.85 | 7.63 | ... | ... |

* Precipitation ·01 inch or more when measurement is in inches ·2mm. or more when measurement is in millimetres.

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE

# Malayan Agricultural Journal

SEPTEMBER, 1930.

## EDITORIAL.

**Storage of Grain.** The publication in this number of an article by Dr. H. W. Jack, on the results of experiments concerned with the storage of rice, directs attention to a subject which, in one form or another, has engaged the attention of many countries. Local reasons may dictate the nature of the particular enquiry and the class of grain concerned, but all these problems possess features in common, so that in the examination of one's local problem, the cognate problems in other countries are well worthy of study.

The main object is to protect grain against mould and insect attacks. The immediate problem in Malaya is to ensure an adequate supply of rice within the country. In this connection, it must be remembered that while over 90 per cent of Malaya's population are rice-eaters, local production can only account for about 40 per cent of the requirements of the country. It is desirable, therefore, that within our shores shall be sufficient supplies of rice to secure the immediate future against unforeseen shortage of supplies.

Ceylon was faced with the problem of the storage of rice. It became necessary in that Colony to ensure the proper storage of rice with the object of preventing the outbreak and spread of plague. Municipal granaries were therefore erected in Colombo and certain regulations framed making compulsory the storage of rice in these granaries. An examination of the construction of the granaries and of the organisation of this storage is of particular interest in the consideration of our own problem. Mr. Bunting, Agriculturist, has visited the Municipal Granaries, Colombo. His report on this subject will be published in this Journal in the near future.

The problem of rice storage bears similarities with that of the storage of maize. Maize differs from most other grains in that the testa is less hard than, for example, padi, wheat, barley or oats, and is in consequence, more easily damaged by insects; while if it is stored in a moist condition, it is very liable to be damaged by moulds. In this respect it rather closely resembles cleaned rice, so that much of the data that has accumulated on the question of storing maize in bulk is applicable to the problem of rice storage.

Grain may be protected against moulds by drying to a moisture content not exceeding 12 to 13 per cent. Protection against insect attack can be secured by storage in tanks or silos which have been rendered insect proof.

To deal with the problem both in the West Indies and in Mauritius, Hess grain driers—capable of handling about 200 tons of grain—were erected. These driers were capable of reducing the grain to the suitable condition of dryness. Storage tanks, capable of being hermetically sealed then protected the grain from insect attacks. The employment of these plants shewed that once the grain had been properly conditioned it could be stored for long periods without deterioration.

It is to be noted that preliminary drying of the grain by artificial means is necessary in countries such as Malaya where the climate is hot and damp, it being impossible to reduce the moisture content of the grain to the requisite degree by air drying alone. Insect attack is apparently less likely to occur under dry than under moist climatic conditions.

The above observations are occasioned by the remarks contained in the article in this number, on the possibility of storing rice in silos. If the parallel which has been drawn with maize is exact, there does not seem to be any reason to suppose that it cannot suitably be undertaken on rice; this is directly borne out by laboratory experiments detailed in the article in question. It is curious that bulk storage on the lines envisaged, so far as we are aware, has not been attempted in the rice industry. Further enquiry on these lines, however, appears to promise satisfactory results.

**Tuba Root.** We are indebted to the United States Department of Agriculture for an interesting article which Mr. R. C. Roake of the Insecticide Division of the Bureau of Chemistry and Soils has submitted to us for publication, and which we have pleasure in including in this number. The author headed his article "A large market awaits tuba root (*Derris elliptica*) in the United States" and thus called attention to a subject of considerable importance to planters in Malaya. The Department of Agriculture, S.S. and F.M.S., from time to time has drawn the attention of investigators and insecticidal firms to the properties of this root. Scientists in various countries have concerned themselves with investigations of the toxic principle of the root, and the effect of tuba extract on various insect pests. In this way, our literature on the subject has been much enlarged in the last two or three years. In this Department we have investigated the variations in toxicity in different varieties, and discovered the optimum age for harvesting. That tuba root is receiving increased attention amongst manufacturers of insecticides is becoming apparent, for from time to time we receive enquiries from different countries for supplies. Cultivators of this crop would be well advised, therefore, to place themselves in touch with the Department in order that they may be kept advised of the extending market and may facilitate our endeavours to popularise this product.

**Tea.** We make no apology for returning once more to the subject of tea cultivation, one of the Malaya's infant industries. The increasing number of our readers interested in this crop will welcome Mr. Bunting's article in this journal on the cultivation of tea in Ceylon

The present article read in conjunction with articles which appeared in the January and March 1930 numbers of *The Malayan Agricultural Journal* will enable the reader to envisage the cultural requirements of this crop under Malayan conditions and in the light of the considerable experience gained by Ceylon planters.

**Vernacular Publications.** This Department has for some years endeavoured to make full use of vernacular publications as a means of bringing the large body of Asiatic planters more closely in touch with the work of the Department. While it is realised that demonstration is perhaps the most favourable means of achieving this result—especially in view of the limited scholastic attainments of the majority of the small-holders—yet such a method has its limits; furthermore, there is a growing desire amongst the more advanced Asiatic planters for more precise knowledge of the advance of agricultural practice in this country.

From the experience of the production of vernacular publications, extending over the past eight years, the Department has built up a somewhat unique organisation for the distribution of its vernacular publications.

Up to the present time, such publications have been in the Malay and Chinese languages. The articles have been especially prepared for them and the growing success of this work is evinced by the fact that there is an increasing demand for these publications in all countries where Malay is spoken or where a large population of Chinese agriculturists exists who are engaged on the cultivation of crops of a similar nature to those of Malaya. For instance, the Government of Sarawak has steadily increased its purchase of these quarterly journals in Malay and Chinese, until at the present time it takes 700 copies of all Malay publications and 500 copies of all the Chinese Journals.

The close liaison between the Department of Agriculture and the Rubber Research Institute of Malaya has resulted in a policy whereby the latter body has adopted the Department vernacular publications for the preparation and dissemination of literature in the vernacular. This arrangement has led to a gradual extention of the range of publications. At the present time, for instance, a series of eighteen pamphlets on various aspects of the rubber planting industry are under consideration, which will be published in the Malay, Chinese and Tamil languages. As we write these lines, delivery is being taken of an illustrated leaflet in Chinese and Malay, published at the request of the Government of Pahang, on Methods for the Prevention of Soil Erosion.

While bearing in mind the limitations of this method of applying scientific results to the small-holder, it is evident that the steadily improving standard of education amongst Asiatics renders the method of growing importance and usefulness.

# Original Articles.

## TEA CULTIVATION AND MANUFACTURE IN CEYLON.

BY

B. BUNTING,
*Agriculturist.*

### Introductory.

In view of the interest now being taken in the cultivation of tea in Malaya, the writer took the opportunity during a recent tour in Ceylon, of visiting several tea estates in the mid-country districts of that Colony. Although the visits were far too brief to make a detailed study of either the cultivation or the methods of manufacture of Ceylon tea, which has now become a specialised industry, much information of a general character was collected in the hope that it may prove of value in developing this industry in Malaya.

### Exports of Tea.

The following figures show the comparative exports of tea from Ceylon during the past three years:—

| *Year.* | | *Black Tea.* | *Green Tea.* | *Total Value.* |
|---|---|---|---|---|
| | | lbs. | lbs. | Rs. |
| 1927 | ... | 225,045,992 | 1,991,864 | 213,774,632 |
| 1928 | ... | 234,890,761 | 1,828,628 | 201,311,006 |
| 1929 | ... | 250,430,570 | 1,157,442 | 205,194,082 |

### General Conditions.

*Situation of Estates.*—The estates visited were situated at elevations varying from 2,500 to 4,500 feet above sea-level, which is known as mid-country.

*Rainfall.*—The rainfall, which in this particular region is fairly evenly distributed throughout the year, varies from 95 to 110 inches per annum, with approximately 190 rainfall days a year.

*Nature of Land.*—The lie of the land on all the estates visited was distinctly hilly and its steepness may be judged by the fact that on one estate of nearly 2,000 acres there was a range of no less than 2,500 feet in the elevation of the planted area. The necessity for taking steps to prevent soil erosion on such precipitous land is one of the most important problems which has to be faced by the management and will be described in detail later.

The soil for the most part may be described as a loose friable loam overlying quartzite rock. Judging by its colour, it is well supplied with organic matter.

Transport facilities are provided by Government roads adjoining all the estates which were visited so that expenditure both in obtaining supplies and despatching the crop is reduced to a minimum.

*Area of Estates.*—The area of the estates visited varied from 700 acres to about 2,100 acres each, but the latter estate was divided into three divisions with a central factory treating the whole of the crop. An area of 750 to 1,000 acres appears to be an economical unit for mid-country tea, although much smaller units are quite common and can be worked at a profit when the overhead charges are restricted to a reasonable limit.

## Draining and Terracing.

In opening up new land for tea, obviously great care must be given to the question of soil conservation. On steep land an efficient system of drainage, combined with terracing, should be adopted at the outset in order to prevent the loss of valuable surface soil.

When laying out the drains the steepness of the land will decide the distance apart at which they are to be spaced. On very steep land they may be spaced 20 feet apart, but with a medium slope the spacing may be increased up to 30 feet. These drains, which are known as side drains, should be about 18 inches wide and 18 inches deep and not more than 100 to 150 feet in length, with a gradient of about 1 in 30. The main or vertical drains for carrying off the surplus water from the side drains should, as far as possible, follow the natural folds in the land, not be too long, and should be arranged in staggered formation down the slope of the hill. Where rock is available these main drains should be protected with broken stone.

The following system of soil conservation, which is a combination of contour draining, silt-pitting and terracing, was adopted on one of the estates visited and was so effective as to warrant a detailed description:—

On the young clearings, where the land was fairly steep, contour drains were dug at distances of 25 feet apart in the centre of the ridge, i.e. that part of the hillside giving the mean angle of slope. The drains had a gradient of 1 in 50 and were 18 inches wide and 18 inches deep. At intervals of 10 feet in the drain were placed bunds of stone, about 3 inches below the edge of the lower side of the drain, with a catch or silt-pit, 2½ feet long by 1 foot deep, placed on the lower side of the bund to check the flow of water. In addition to this a further bund of stone, 12 inches high, was placed along the upper side of the drains and about 18 inches from the edge. This bund was increased to a height of 18 inches as the soil filled up to the level of the original bund. These drains were not more than 100 feet in length and as far possible, followed the natural depression in the land so that they discharged into the main or leading drains in a natural ravine.

It is suggested that this system could be greatly improved by placing an additional stone terrace, about 9 to 12 inches high, intermediate between the drains in order to save the lower bund from becoming too high as a result of the collection of silt from the slope above.

Climbers and ferns are allowed to grow on the stones forming the terrace so as to bind them together, and as a further precaution against loss of soil, a ground cover of *Indigofera endecaphylla* is now being planted between the terraces.

The management of this estate has fully realised the value of taking every possible precaution for arresting soil erosion on such steep land and there is no doubt that the money expended on this work will be amply repaid in the future by increased yields of tea.

## Planting.

The distance of planting having been decided upon, the land is then carefully lined and holed ready for planting at the beginning of one or other of the monsoon seasons. It is usual to dig cylindrical holes and these should not be less than 18 inches deep and 12 inches across the top. The earth removed from the holes should be placed between the lines and after allowing the holes to remain open for some days, for the purpose of aeration, they should be filled in with good surface soil ready for planting.

The most suitable spacing of the plants will depend to a certain extent on the situation of the estate and tea grown at higher elevations is usually planted much closer than that at the lower altitudes.

The usual distance of planting in the mid-country districts is 4 ft. × 3 ft., but in some cases 3 ft. 6 ins. by 3 ft. is adopted, especially on wind-swept ridges. On up-country estates 3 ft. 6 ins. × 3 ft. and 3 ft. × 3 ft. appear to be mostly in favour.

The following table shows the number of bushes per acre at various distances of planting:—

| | | | | | | |
|---|---|---|---|---|---|---|
| Bushes | planted | 3′ 0″ × 3′ 0″ | = | 5,590 | per | acre. |
| ,, | ,, | 3′ 6″ × 3′ 6″ | = | 4,170 | ,, | ,, |
| ,, | ,, | 4′ 0″ × 3′ 0″ | = | 3,630 | ,, | ,, |
| ,, | ,, | 4′ 0″ × 3′ 6″ | = | 3,111 | ,, | ,, |
| ,, | ,, | 4′ 0″ × 4′ 0″ | = | 2,722 | ,, | ,, |

The various methods of planting up new areas include (a) seed at stake, (b) germinated seed, (c) basket seedlings and (d) plants raised in nursery beds.

One of the best methods is to plant seed at stake, allowing two or three seeds per hole and thin out the weakly plants later. Freshly germinated seed may also be employed for this purpose with satisfactory results, but seed at stake has a better chance of surviving a drought experienced soon after planting than has germinated seed, which has not had time to get its roots established. The seed can be shaded by fern with good results.

When plants are required, the seed is sown in raised nursery beds at a depth of one to two inches and spaced 4 to 6 inches apart. The beds should be lightly shaded and regularly watered until the young seedlings are well established. After about 6 months the shade is removed so as to harden the plants. They should be ready for planting out after about one year, but they may remain in the beds up to a period of two years if necessary. When the plants are removed from the nursery beds, the tap-roots are cut off, leaving about one foot in length, as well as the tops of the plants to within 6 or 8 inches of the collar. A round, pointed, hardwood stick is used for making the hole for planting. Care should be taken that the roots are not bent during the operation of planting and the earth is well pressed round the plant to within about an inch above the collar. The young plants should be shaded with bracken until they become established.

Basket plants or two-year-old stumps are found the most satisfactory for supplying any vacancies which may occur later.

### Weeding.

The system of clean weeding is almost universal on tea estates in Ceylon, but it is somewhat questionable whether the advantages of such a system are not outweighed by its numerous disadvantages, the chief of which is the loss of valuable surface soil as a result of wash.

On the majority of estates a system of monthly hand weeding is adopted, but on others noxious weeds only are removed and indigenous leguminous plants or harmless weeds, such as *Oxalis violacea*, are allowed to grow so as to protect the surface soil on steep slopes liable to wash during heavy rain. Climbers and ferns are also allowed to grow over the stone bunds built to prevent soil erosion so as to bind them together.

### Cover Crops and Green Manures.

The use of low-growing leguminous cover crops has been given a trial on some of the more progressive estates and *Indigofera endecaphylla* is being employed for this purpose. This plant has proved to be a most satisfactory ground cover for estates where it can be established. On some estates, however, *Oxalis violacea*, a non-leguminous plant, is commonly allowed to establish itself and constitutes a fine soil protector.

*Tephrosia candida* (Boga medeloa) and *Leucaena glauca* are employed as green manures to a small extent, but these are not so much used as the more woody type of plants such as *Gliricidia maculata* and *Erythrina lithosperma* (Thornless Dadap).

In one case *Tephrosia candida* was planted on the terraces. The plants are cut back twice a year and the prunings stacked behind the terraces. In another case it was planted about 18 inches above the drains as close together as possible so as to form a hedge. The plants are cut back every three or four months and the cuttings either placed behind the hedge or dug into the soil.

On another estate, with very light soil, it was planted on the terraces and between every other row. In this case it was cut and buried three times a year and uprooted at the end of the third year.

*Gliricidia maculata* and *Erythrina lithosperma* are usually planted 15 feet apart, parallel with the drains, with two plants between the drains, so as to miss the edges of the drains, and in the rows of tea bushes. The plants are cut back to 8 feet at the first pruning so as to get a bowl-shaped tree. Afterwards they are pruned back to within about a foot of the old cut three times a year until the plants get too high, when they are cut back to the original level at 8 feet above the ground. The prunings are dug into the soil by what is called "envelope" forking. In this way large quantities of organic matter are incorporated in the soil. An additional advantage derived from planting leguminous shrubs and trees, such as those described above, is that they have the property of collecting nitrogen from the air by means of nodules on their roots, thus enriching the soil in this important constituent of plant food.

At elevations of 4,000 feet and over *Acacia decurrens* is commonly used for green manuring purposes. The distance of planting will depend on whether the plants are required to serve as a wind-break in addition to providing supplies of green manure. In the former case the trees are usually planted in belts 18 to 20 feet apart and 10 to 12 feet between each tree in the rows, depending on the spacing of the tea.

## Shade Trees and Windbreaks.

*Albizzia moluccana* is universally employed as high light shade. The trees are usually planted 40 ft. × 40 ft. in new clearings. Later, every other tree in alternate rows is cut out and eventually the remaining trees in these rows are removed, leaving a spacing of 80 ft. × 40 ft. or approximately 15 trees per acre. The rows of shade trees should run north and south in order that the tea bushes may receive the maximum amount of shade. This tree does not stand pruning as it contracts disease and always dies back afterwards.

*Grevillea robusta,* although providing a certain amount of shade, is planted as a wind-bread on the more exposed ridges. For this purpose it is planted in double rows about 6 feet apart, the plants being alternated to form a screen. The rows are planted either against the prevailing winds or on the edges of paths and may be spaced several chains apart. The leaf-fall from these trees makes a splendid ground mulch.

## Pruning.

There are numerous systems of pruning tea and it is impossible to lay down any hard and fast rules as to the method of pruning. In each case the main object is to promote vigorous growth with a view to maintaining the production of leaf. The operation should, as far as possible, be carried out at the beginning of a wet season because at this stage the bushes are full of sap, which naturally promotes a flush of new and vigorous growth.

The following is a brief description of the system of pruning which was adopted on an estate in mid-country:—

Whether the tea is planted from seed at stake or germinated seedlings, after about 9 months growth, or when the seedlings are roughly 9 inches in height, they are pruned back to within 3 inches of the ground or the lowest leaf or side shoot. They are allowed to grow up again and 9 months later are cut back to within 6 inches of the ground, i.e., 3 inches above the old cut, just above an outward bud. A further 8 or 9 months later they are again cut back to within 3 inches of the previous cut leaving 9 inches of wood. After this stage ordinary plucking takes place, leaving one leaf above the fish leaf, care being taken not to pluck shoots below the level and leaving outward growing branches to develop frames. At each cutting outward growth is encouraged and centre upward growth checked.

Subsequently, normal one and a half or two years pruning is adopted according to the development of the bushes. Such pruning is only carried out from the beginning of April to the middle of September. The reason for this is that the April rains, which follow the drought during the periods January to March, cause a strong flow of sap which encourages callus growth on the edges of the cuts and vigorous new shoots. The bushes are pruned roughly to a level, but pruning to an outward bud is equally important so as to encourage outward growth. The good growing months are September, October and November, but the best flushes are usually obtained in April and May although such flushes are of comparatively short duration.

A new clearing planted from seed at stake in July/August, 1927 under the above system of pruning was put into plucking during March, 1930. The method adopted resulted in the production of a large number of side branches making the frame and in less than three years from the time of planting the bushes average 24 inches across the top.

Once the bushes come into plucking the interval between prunings may vary from two years on mid-country estates up to three or even four years on up-country estates.

## Plucking.

The first plucking, which is really tipping to get the bush into formation, sometimes takes place 6 weeks after pruning, but generally after 2 months on mid-country estates. At the higher elevations it may take up to 3 months before plucking is recommenced, but the period depends on the style of pruning adopted.

The present system of plucking is to take a bud and two leaves only, leaving one leaf above the fish leaf. At the same time the "bangy" or abortive shoot is collected to encourage flushing. The old system was to take the bud or tip and two leaves and if a third leaf was present above the fish leaf take three-quarters of it and throw away the lower portion of the stalk. The latter gives the red leaf and hard stalk which has to be removed by hand-sorting. Normally, there should not be a third leaf present above the fish leaf if the plucking round is carried out quick enough. Plucking usually takes place at intervals

of 9 or 10 days, but in the rush seasons, i.e., April/May and September/October, the interval between plucking is reduced to 7 or 8 days.

Following pruning, the more experienced coolies pluck the bushes for 9 months or a year when they will gather from 40 to 60 lbs. of fresh leaf per day. After this the old women and children take it over and carry on until the bushes are due for pruning again. During the latter period the average amount of fresh leaf plucked daily will vary from 13 to 18 lbs. per cooly.

On another estate, where plucking is carried out regularly at intervals of 8 or 9 days, a cooly will pluck as much as 40 to 60 lbs. of fresh leaf per day during the heavy flush and about 10 lbs. of leaf per day when the flush is poor. Taken over the whole year an average of about 18 lbs. of fresh leaf per cooly per day may be considered satisfactory. A plucker receives a bonus of one cent per pound for anything above 20 lbs. per day.

Plucking goes on all the year round and a permanent gang of about 250 women pluckers is required for every 500 acres of tea in bearing.

The egg-shaped plucking basket is considered preferable to other types since the leaf is much less liable to become bruised during plucking operations. The size of the plucking baskets is 30 inches deep and from 14 to 16 inches in diameter. On no account should the leaf be pressed down in the baskets and for this reason frequent collection and despatch of the green leaf from the field to the factory is essential, more particularly during the heavy flushes.

## Cultivation and Manuring.

The cultivation of tea is generally restricted to forking, either in connection with the application of artificial fertilisers or in the periodical incorporation of prunings of green manures by what is known as "envelope" forking. Hand-digging with forks not only aerates the soil but has the effect of conserving soil moisture by reducing the surface evaporation, which naturally takes place on hard baked soils.

The continuous cropping of the tea plant rapidly denudes the soil of its essential constituents of plant food and it is therefore necessary that both forking and periodical digging in of green manures be supplemented by the regular application of artificial manures, in some form or other, in order to maintain the health and vigour of the plant.

The present practice in Ceylon is to apply what is known as a "pruning mixture" a few months before pruning takes place and this is followed by a "general mixture," which is usually applied about nine months or a year after pruning.

The composition of the mixtures varies considerably on different estates, but the system adopted on one estate was to apply 1,000 lbs. of fertilisers over a period of two years to cover a two-year pruning cycle. The two mixtures are made up as follows:—

(a) *Pruning Mixture.*

| | | Nitrogen. | Phosphoric Acid. | Potash. |
|---|---|---|---|---|
| 150 lbs. | Fish guano ... | 10.5 | 12 | — |
| 80 ,, | Nitrate of potash ... | 8 | — | 26.4 |
| 100 ,, | Ephos phosphate ... | — | 30 | — |
| 70 ,, | Sulphate of ammonia ... | 14 | — | — |
| 50 ,, | Superphosphate ... | — | 9 | — |
| 450 lbs. | | | | |

(b) *General Mixture.*

| | | Nitrogen. | Phosphoric Acid. | Potash. |
|---|---|---|---|---|
| 100 lbs. | Groundnut cake ... | 7 | — | — |
| 200 ,, | Fish guano ... | 14 | 16 | — |
| 50 ,, | Muriate of potash ... | — | — | 25 |
| 100 ,, | Blood meal ... | 11 | — | — |
| 50 ,, | Sulphate of ammonia ... | 10 | — | — |
| 50 ,, | Superphosphate ... | — | 9 | — |
| 550 lbs. | | | | |

On some older areas the general mixture has been increased to 750 lbs. per acre on account of the largely increased size of the bushes.

The common method of applying these mixtures is to broadcast the manure in the lines between the bushes. The forking gang then follows and fork it in below the surface. Another method is to sprinkle the mixture in a circle about 18 inches round the bushes and fork it into the soil.

The loppings from the green manures, such as *Gliricidia maculata* and *Erythrina lithosperma*, are incorporated with the soil by "envelope" forking at the same time as the artificials are applied. The artificial manures add 10 cents per lb. to the cost of the prepared tea and on some of the more progressive estates an equal amount is expended on green manuring with excellent results as regards increase in yield, new wood growth callus healing of wounds and well developed frames.

(c) *New Clearing Mixture*

| | | Nitrogen. | Phosphoric Acid. | Potash. |
|---|---|---|---|---|
| 50 lbs. | Fish guano ... | 3.5 | 4 | — |
| 50 ,, | Sulphate of ammonia ... | 10 | — | — |
| 150 ,, | Superphosphate ... | — | 27 | — |
| 250 lbs. | | | | |

The above mixture is applied to plants after centering at the rate of 2 ozs. per bush. It is dibbled in at a distance of about 6 inches around the young bushes.

## Diseases and Pests.

Brown root disease (*Fomes lamaoensis*), Poria (*Poria hypolateritia*), Ustulina and Diplodia (*Botryo diplodia*) are amongst the most prevalent diseases of tea in Ceylon.

The burying of tea prunings among the bushes frequently contributes to the outbreak of these diseases.

One of the principal pests is the shot-hole borer, (*Xyleborus fornicatus*) which is always existent and is most noticeable by broken branches about 18 months after pruning. The beetle perforates the stems and branches making a circular gallery where it lays its eggs. The entrance is usually at a node. When bushes are weak the branches snap off at the gallery, thus ruining the frames. There is no cure for this trying pest, but manuring—by maintaining the vigour of the bushes—helps the bushes to fight against the attack.

The best method of combating pests and diseases is by adopting preventive measures and not allowing the bushes to become weakened either by hard plucking or by permitting them to grow too high before pruning.

The caterpillar of the tea tortrix (*Homona coffearia.*) is also responsible for much damage. The methods adopted for the control of this pest are not altogether satisfactory, but it has been established that tea bushes which are regularly manured and kept in a good state of cultivation are much less susceptible to the attacks of the pest. Various species of termites also cause considerable damage and require to be kept in check.

## Seed-Bearers.

Since the importation of tea seed from India and Assam is at present prohibited, it is necessary for Ceylon to rely entirely on locally produced seed for planting up new areas or supplying old ones. On some estates, therefore, small areas of tea plants are not pruned or plucked, but allowed to develop as seed-bearers.

The tea plant is very liable to cross fertilisation, consequently it is better to select seed of a first class jat and plant up a small area in the jungle where it can be completely isolated from all other jats. In this case it should be planted at distances of 12 ft. x 12 ft. or even 15 ft. x 15 ft. and allowed to grow naturally into the form of a tree. After about 4 or 5 years from planting the trees will begin to produce good crops of seed, but they do not reach maturity until they are from 8 to 10 years old. It takes about 14 to 15 months from the time of flowering to the production of ripe seeds and it is stated that a yield of from 10 to 15 maunds of good seed is obtained per acre according to conditions.

## Manufacture.

Although the general principles of the method of manufacture of tea are much the same throughout the Island, there is considerable variation in carry-

ing out the different processes even on adjoining estates and it is, therefore, only possible to give a rough outline of the procedure generally adopted in the factory.

The various processes through which the leaf passes in the factory include (a) withering, (b) rolling and roll-breaking, (c) fermenting, (d) firing or drying, and (e) grading. These operations are briefly described below:—

## Withering.

This is probably the most important operation in the manufacture of black tea and many factors have to be considered in order to obtain a good and even wither.

The fresh leaf on arrival at the factory is first weighed and then transferred to the withering loft, where it is spread out in thin layers on tats made of hessian. The height of the withering loft is 8 ft. 6 ins. and each frame carries 17 tats, which are spaced 5 inches apart, leaving extra space near the ceiling to allow of free circulation of air. The tats are usually 40 feet long and consist of a double bank of 45 in. hessian, which is sewn together at the centre and then secured to a permanent wire frame by means of small wooden pegs. If a wire frame is not used, considerable space is lost by the edges of the tats curling. The tats have a slope 3 inches downwards from the centre to facilitate the removal of the withered leaf. The passage between the tats is from 22 to 24 inches wide and that on the ends about 3 feet wide.

The loft is fitted with a large number of glass windows of the single venetian type, which can be opened in dry weather to allow of the free circulation of air. A bulking chamber is fitted in the centre of each loft and two large "boosting" fans placed in this chamber draw hot air from the drying room, which is bulked with air from the atmosphere. The mixture of hot and cool air is then pushed through the lofts to regulate the humidity. In other cases two exhaust fans are placed at the end of each loft for controlling the movement of the air inside the lofts.

The fresh leaf is spread very thinly on the tats, the usual practice being to allow 1 lb. of fresh leaf to 15 square feet of tat space. Assuming that each tat contains 127½ square feet it would therefore take 8½ lbs. of fresh leaf. In order to get an even distribution on the tats it is advisable to provide the cooly with a basket holding sufficient leaf for one tat.

The withering process, in favourable weather, usually takes 18 hours to complete. It may, however, proceed up to 24 hours with good results, but after this the leaf begins to decompose and smell. When the leaf is properly withered it has an apple-like smell and if pressed in the hand will expand slowly like a silk handkerchief does when treated in the same way. A wither of 53 to 56 per cent. is considered the best for general purposes, but in some cases it may be from 55 to 58 per cent. The leaf on arrival at the factory contains about 75 per cent. of moisture so that a wither of 55 per cent. means that 100 lbs. of fresh leaf has lost 45 lbs. of water during the process of withering.

Hygrometers should be placed both on the outside and on the inside of the loft and the temperature of the dry and wet bulbs recorded daily at 7 a.m., 1 p.m., and 4 p.m. for the purpose of regulating the humidity of the loft.

The following hygrometer readings were observed in one loft at 10.30 a.m. :—

| | *Inside Loft.* | *Outside Loft.* |
|---|---|---|
| Dry bulb | ... 82°F. | 78°F. |
| Wet bulb | ... 76°F. | 70°F. |

The difference of 6°F. in the wet and dry bulb inside the loft is considered ideal conditions for withering.

In dry weather the free circulation of air is regulated by opening the windows on the sides of the loft, but during moist weather the hot air from the drying room is passed into a central bulking chamber, fitted with wooden shutters, and drawn through the loft by means of large suction fans placed at each end.

The leaf is not turned during the withering process, but boys are sent round to break up any lumps and see that the spreading of the leaf on the tats is uniform. The leaf should be handled as little as possible in the factory as well as in the field. Further, only sufficient leaf should be removed from the tats to fill the rollers, because if it is allowed to remain in heaps on the floor of the loft it will begin to ferment and deteriorate in quality. The first leaf should be weighed when it arrives at the factory and a record kept of the quantity of leaf placed on each bank of tats. The actual degree of withering may be ascertained by weighing a definite quantity of leaf and comparing it with the weight on arrival at the factory. It will then be possible to check the number of tats which must be cleared to provide the necessary charge for the rollers.

## Rolling.

When the leaf is withered the next process is that of rolling. In this operation the withered leaf is placed in the roller, which usually consists of a fixed table, covered with battens, a bottomless box and an adjustable lid. As a rule the table is stationary, but the box and its lid revolve eccentrically on the table at a speed of about 40 revolutions per minute. This movement causes a certain amount of friction with the result that the leaf becomes heated, which in turn produces fermentation. It is therefore necessary to regulate the pressure on the leaf by means of the adjustable lid and in practice little or no pressure is applied during the first period of rolling. In subsequent rollings, however, the lid is lowered into the box and pressure is thereby exerted on the leaf and the pressure is gradually increased until the final rolling. There is so much heat generated during hard rolling that it is necessary to lift the lid periodically for a few minutes so as to allow the leaf to cool down.

There are many systems of rolling which vary from 3 rolls of long duration to 5 or more rolls of short duration, the extent of rolling being much the same in each case. In actual practice, the time taken in rolling and the

fermentation of the tea generally occupies about $3\frac{1}{2}$ hours for the two processes, which are really combined, as will be described later.

The general practice in Ceylon is to roll for a period of 2 to $2\frac{1}{2}$ hours with rolls of varying duration, which can only be determined by experience in manufacture.

The rolled leaf is passed over the roll-breaker after each roll and that portion passing through the No. 5 mesh is termed "dhool" and comprises what is known as the broken grades, while the portion passing over the top of the wire mesh is known as "bulk". When the rolled leaf after the first roll is passed over the roll-breaker, the fine leaf and tips are separated from the coarse leaf so that light pressure can then be applied to the remaining bulk, the pressure being gradually increased after each period of rolling.

The following are examples of the different systems of rolling adopted on four estates situated in mid-country within a comparatively short distance of each other :—

*Estate A.*—The former method of rolling consisted of 8 periods; the first 3 rolls for 30 minutes each and the next five rolls for 20 minutes each, the leaf being passed through the roll-breaker after each period of rolling. No pressure is applied during the first roll, very little during the second and third, but the pressure is gradually increased until finally hard pressure is reached. If a 52 per cent. wither is obtained the pressure can be applied harder after the second roll.

The present system consists of 7 rolls comprising two rolls of 30 minutes, three rolls of 20 minutes and two rolls of 15 minutes. If the leaf is not too much withered another roll of 15 minutes is given.

*Estate B.*—The method of rolling at present adopted is 5 rolls of 30 minutes each. There is no pressure on the first roll, light pressure on the second and heavy pressure on the last three rolls. In the latter case the pressure is maintained for periods of 10 minutes and then the lid is lifted for 2 or 3 minutes to allow the leaf to cool down. Three rolls are filled with leaf at the same time and after the first roll the big bulk is combined in two machines and after the fourth roll into one machine.

*Estate C.*—The method of rolling adopted on this estate was 5 rolls, comprising 3 rolls of 30 minutes each and two rolls of 20 minutes each, all hard pressure in order to get as much broken leaf as possible with a view to obtaining strength and colour.

*Estate D.*—The present method of rolling consists of 5 rolls of 30 minutes each as follows :—

1st Roll—30 minutes, no pressure with lid just touching the leaf.
2nd Roll—30 minutes, lid 5 minutes on and 10 minutes off.
3rd Roll—30 minutes, lid 10 minutes on and 5 minutes off.
4th and 5th Rolls—30 minutes each, as hard as possible without heating the leaf.

This gives $2\frac{1}{2}$ hours actual rolling, but allowing a quarter of an hour for each breaking process, one hour altogether, the whole operation of rolling takes $3\frac{1}{2}$ hours to complete.

It will be seen from the above examples that there is considerable variation both in the number of times rolled and their duration. This variation depends on the grade of tea to be manufactured; where a large percentage of broken grades is required the pressure is increased so that more leaf passes through the roll-breaker. The hard rolling gives the tea strength, whereas light rolling, in which the leaf is kept as cool as possible, gives it flavour.

The tables on which the rollers work are sometimes made of brass, but more usually of wood. It is stated that wooden tables give a better grip on the leaf when rolling and that tea rolled on wood frequently realises a higher price than that rolled on brass. The drawback is that wooden tables require renewing every 18 months, whereas brass is far more lasting. The tables are fitted with battens, which give the leaf a twist or curled appearance. There are many types of battens, but Reeves battens are probably the most popular.

It is estimated that one full-sized 36 inch roller is required for every 65,000 lbs. of made tea so that the factory will be fully equipped. Many factories, however, are equipped with one roller for every 80,000 lbs. or up to 100,000 lbs. of made tea, which is generally inadequate. In practice, a 36 inch roller will take a charge of about 300 lbs. of withered leaf, although the makers usually estimate its capacity at 360 lbs. per charge.

The speed at which the rollers revolve may vary from 20 to even 60 revolutions per minute as extreme limits, which will depend on the type of roller and the form of battens fitted to the table. For general purposes a roller with a fixed table should work at about 35 to 40 revolutions per minute.

It is of great importance that the rolling room should be as cool as possible and provided with a free circulation of fresh air so as to retard the process of fermentation.

## Fermentation.

The process of fermentation is generally carried out on tables situated in the rolling room, but in some cases a separate fermenting room is provided for this purpose.

The fermenting tables are usually made of angle iron, expanded metal and concrete. Ordinary wire may, however, be used instead of expanded metal. The layer of concrete should not be more than $1\frac{1}{2}$ inches thick and each rack should have either 2 or 3 shelves. It is found that concrete is better than glass for fermenting as the latter is too clean and consequently retards the bacterial action so necessary to fermentation.

The dhool coming from the roll-breaker is placed on the fermenting trays to a uniform depth of $1\frac{1}{2}$ to 2 inches. In one case the first two lots of dhool are allowed to ferment on the tables for 1 hour, the remainder going straight from the roll-breaker to the firing machine, having fermented sufficiently during the rolling process. In another case the first lot of dhool is left on the fer-

menting trays for a period of 1 to $1\frac{1}{2}$ hours, the balance remaining on the trays for shorter periods, according to the length of rolling, and only the last lot of dhool going straight to the firing machine. In both cases the fermenting tables are placed at one end of the rolling room.

On another estate, which had a separate room for fermenting, the first three lots of dhool are fermented on the trays for a period of $2\frac{1}{2}$ to 3 hours, the last two dhools being taken direct to the drier for firing.

Since the process of fermentation goes on during the operation of rolling it is nearing completion as the last roll is finished and the coarse leaf is therefore fermented while in the roller.

The temperature of the fermenting room should not be allowed to exceed 70° to 75°F. On one estate visited, the rolling and fermenting rooms were combined and the temperatures in three different places in this room were as follows:—

| | | | | | | |
|---|---|---|---|---|---|---|
| (1) | Dry bulb | = 68.5°F. | and wet bulb | 69.0°F. | (near humidifier) |
| (2) | ,, | = 69.5°F. | ,, ,, | 69.5°F. | (centre of room) |
| (3) | ,, | = 70.25°F. | ,, ,, | 70.5°F. | (end of room) |

These are considered ideal temperatures for rolling and fermenting. The corresponding outside temperatures were—dry bulb 75.5°F. and wet bulb 68.25°F.

When a separate room is used for fermenting, it is usually constructed of brick walls with pigeon holes on one side. One end of the room is partially open and this opening is covered with wet sacking, while an exhaust fan, placed at ground level at the other end, draws the moist air through the room, thereby increasing in humidity.

The humidity of the atmosphere of the fermenting room should be kept as near saturation point as possible so as to prevent any drying of the fermenting leaf.

In order to achieve the best results cleanliness in both the fermenting and the rolling rooms must be strictly observed.

## Firing.

The principal object of firing the leaf is to extract the surplus moisture and thereby to arrest fermentation.

The fermented leaf is transferred from the fermenting room in a specially made box or basket holding exactly 5 or 8 lbs. of leaf according to the capacity of the trays. The leaf is then spread evenly on the tray to a depth of about half an inch. The length of time taken in firing the leaf will depend on (a) the temperature of the drier, (b) the thickness at which the leaf is spread on the trays and (c) the extent of the wither.

The following figures show the various temperatures and the duration of firing on four different estates:—

| | *Temperature of drier.* | *Duration of firing.* |
|---|---|---|
| Estate "A" | 175° to 180°F. | 15 to 20 minutes. |
| ,, "B" | 180°F. | 20 ,, |
| ,, "C" | 180° to 190°F. | 20 to 25 ,, |
| ,, "D" | 200° to 220°F. | 25 to 30 ,, |

When the tea leaves the drier it should be quite crisp and if properly dry, the coarser leaves can easily be crushed into a powder when rubbed between the hands. Immediately after its removal from the drier, the fired leaf is spread out on the floor of the drying room and allowed to cool, after which it is placed in either zinc or wooden airtight bins, where it is stored ready for sifting and grading. It should be placed in the storage bins while slightly warm.

Attention should be drawn to the fact that the capacity of a drier is generally about half that estimated by the makers. The reason for this is that the makers base the capacity on a temperature of 220° to 230°F. and a wither of 60 per cent., whereas the common practice in Ceylon is to fire the tea at a temperature of 180° to 200°F. with a 50 to 55 per cent. wither.

## Final Firing.

It is usual to give the sorted tea a final firing at a slightly lower temperature immediately before packing so as to remove any surplus moisture.

## Sifting.

The fired tea is next transferred from the storage bins to the sifting room, where it is passed through sifting machines which separate the tea into 7 or 8 different grades according to size.

A separate room should always be provided for sifting the tea. A 36 inch exhaust fan is placed at floor level at one end of the sifting room to draw away the fluff.

In the process of sifting, the dhool is passed through a standard 4 tray sifting machine producing five grades of tea. The first grade is Broken Orange Pekoe and Orange Pekoe from No. 10 sieve, the second Pekoe from No. 8 sieve and the third heavy bulk from No. 6 sieve. The latter is put into a cutting machine and sized. After sizing it is put back into the sifting machine where it is graded into Broken Pekoe, Pekoe and Pekoe Souchong.

The Broken Orange Pekoe and Orange Pekoe are whole leaf uncut teas, while Fannings and Dust come from Nos. 24 and 30 sieves.

All the big bulk is hand-picked for the removal of red leaf and hard stalks. This is carried out by women who work on zinc-covered tables.

The following is a list of the various grades of tea which are manufactured on one mid-country estate, together with the percentage of each grade produced under present conditions:—

| | | |
|---|---|---|
| Broken Orange Pekoe | ... | 51.65 per cent. |
| Broken Pekoe | ... | 11.55 ,, |
| Orange Pekoe | ... | 6.30 ,, |

| | | | |
|---|---|---|---|
| Pekoe Souchong | ... | 2.05 | ,, |
| Souchong | ... | 1.24 | ,, |
| Pekoe | ... | 23.93 | ,, |
| Fannings | ... | 2.40 | ,, |
| Dust | ... | 0.88 | ,, |
| | | 100.00 | per cent. |

The tea cutter is usually fitted with either 5/6″ or 1/4″ cells and on some estates they have two cutting machines, one of each size. In this case the tea is passed through the 5/16″ cell cutter and then transferred to the 1/4″ cell cutter for final cutting. Where only one size cutting machine is employed it is necessary to pass the big bulk tea through the cutter several times.

The percentage of made tea to fresh leaf, without deducting anything for surplus moisture of the leaf during wet weather, is approximately 23.5 per cent. taken over the whole year. This figure was obtained in a mid-country district with a rainfall of about 95 inches per annum. After sifting, the different grades are stored in bins until there is a sufficient break of each ready for packing. As a rule the tea is stored in the bins for about a week, but some of the lower grades are kept up to 3 months. These storage bins are usually constructed of teak and are 4 feet wide i.e., 2 feet on either side of the partition between the sifting and packing rooms. Sometimes the bins have sufficient clearance as the base to allow of a packing case being placed below.

## Packing.

Before packing, each grade of tea is carefully bulked on the floor of the drying room so that the various days' makes of the same grade will be thoroughly mixed together. The bulked tea is then placed in the drier for about 2 or 3 minutes and refired at a temperature of 80° to 90°F. after which it is packed in lead-lined momi or venesta cases while it is still warm, but not hot.

During the operation of packing, the chest is clamped on a vibrating table which gives a shaking motion backwards and forwards, thus ensuring that the maximum quantity of tea is packed in each chest. A full-sized chest contains approximately 115 lbs. of B.O.P., while Fannings and Dust, being heavier, are usually packed in half chests containing 85 to 100 lbs. nett weight.

A break is 1,000 lbs. or over and is sold in the open market, lesser quantities being disposed of at the auctions after the large breaks have been sold.

## Factory.

The tea factory should be a cool, airy, well-lighted building and situated in an open position about the centre of the estate.

The ground floor contains all the machinery and is usually divided up into (a) rolling and fermenting room, (b) firing and packing rooms, and (c) sifting

and grading room. There are generally two or three upper floors which are fitted with double banks of tats for withering the leaf.

The long axis of the factory building should run east to west and the rolling room should preferably be located on the west end of the building, so as to be as cool as possible, the firing and packing room in the centre and the sifting and grading room, which should be well lighted, at the opposite end.

The height of the withering loft is generally 8 feet from the floor to the ceiling, but in some cases the height of the first loft is 8 ft. 6 ins. and the other two lofts 8 feet only. These lofts should be well provided with windows, which can be easily opened so as to allow of the free circulation of air inside.

Formerly, when the leaf was spread very much thicker than it is at present, two withering lofts were considered sufficient, but with an allowance of 1 lb. of fresh leaf per 15 square feet of tat space, a third loft is now required.

Outside lean-to verandahs are generally erected along the sides of the ground floor so as to give more floor space. The roofs of these verandahs are taken up to the lower edge of the windows in the first floor withering loft so as to give increased height and allow of better lighting.

Great care and attention is given to the cleanliness of the tea factories and the cleaning of each room is systematically carried out so as to prevent any dust or rubbish becoming mixed with the tea while it is passing through the various processes of manufacture.

## Machinery.

The power required for a tea factory is generally calculated at from 8 to 10 H.P. for every roller installed, which includes the running of the drying and sifting machines, shafting and fans. Further, it is estimated that a full size, 36 inch roller is required in respect of every annual output of 65,000 lbs. of made tea so that the factory will be fully equipped. Many factories, however, are only equipped with one roller for every 80,000 lbs. of made tea, which is generally inadequate. It is usual to allow one roll-breaker to 2 full-sized rollers, but in large factories the proportion can usually be reduced to 2 roll-breakers to 5 rollers.

The following is a list of machinery which would be required for a factory with capacity of 400,000 lbs. of made tea per annum:—

- 3 Jackson/Marshall 36 in. Circular Rapid Rollers, working capacity 300 lbs. per charge.
- 1 Walker's 32 in. "Economic Roller," working capacity 250 lbs. per charge.
- 2 Roll-breakers, 12 feet long.
- 2 Drying Machines, working capacity 90 to 100 lbs. each per hour.
- 1 Walker's 4 tray Sifting Machine.
- 1 Michie 2 tray Sifting Machine.
- 1 Double Cutting Machine, ¼ in. cells.
- 1 Packing Machine.
- 2 50 H.P. Crude Oil low-pressure Engines.

(Where water power is available a Pelton wheel may replace one of the engines).

The factory should be equipped to turn out one-third more than the average daily output so that an estate with a crop of 400,000 lbs. should have a factory capable of dealing with a crop of 600,000 lbs. of made tea per annum. In one mid-country district 40 per cent. of the crop is obtained between July and December and 60 per cent. between January and June. In the rush season the factory may have to work day and night, but only for a comparatively short period and if withering accommodation and machinery is insufficient.

## Yields.

It is estimated that an area planted from seed at stake will produce a crop of from 300 to 400 lbs. of made tea per acre in the fourth year from planting. One mid-country estate actually produced 600 lbs. of made tea per acre in the fourth year from an area of really good land.

The average yield of made tea on the older areas is between 500 and 525 lbs. per acre, but on one estate, which is spending as much on green manuring as it does on artificial manures, the yields average from 550 to 575 lbs. per acre per annum.

## Supervision.

On large estates it is considered that one European assistant is required for every 500 acres of tea cultivated if the various works are to receive proper supervision. On one estate, however, situated on very steep land, one European assistant is employed for every 400 to 425 acres under tea.

## Labour.

Formerly, 1 cooly per acre was required to work a tea estate efficiently, but under present-day conditions and methods 1½ coolies per acre is considered to be necessary for all works.

The proportion of men to women, including working children, is usually about equal. The standard rates of pay in the mid-country districts under the Government Wage Ordinance are men 52 cents,* women 41 cents and children (10 to 14 years) 31 cents per diem. for a 9 hour day, i.e. 8 hours actual working.

## Returns.

The all-in cost of production may vary from 55 to 58 cents per lb. of made tea on a crop of 550 lbs. per acre. This includes the cost of manuring, which is roughly 10 cents per lb. of made tea.

The average price realised for all grades during 1928/29 was about 90 cents per lb., which showed a profit of approximately 35 cents per lb. of made tea.

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* 100 cents of a Rupee, equivalent to 1 shilling and 6 pence (approx.).

As a rule, the cost of production on mid-country estates is about 55 cents per lb., whilst up-country high-grown teas will cost as much as 60 cents per lb. of made tea to produce, but with correspondingly higher sale prices on account of flavour.

It is stated that certain estates in various districts are producing at a cost of 47 to 50 cents per lb., but these are heavy-yielding properties which produce a crop of 750 to 1,000 lbs. of made tea per acre per annum.

It is estimated that the cost of bringing a tea estate into bearing, including factory and machinery, in mid-country districts would be from £100 to £150 per acre depending on the cost of the land and the type of factory installed. Under such conditions, a profit of from 10 to 15 per cent. may be expected on the capital outlay.

## General.

Each day's make of tea is tested daily so that any merits or defects in the manufacture of the tea can be detected. The apparatus required for tea testing includes a set of white cups and pots, a sand glass, a stove and a small tea testing scale so that a standard weight of tea is taken for each test.

The method of testing is to bring the water up to the boil and allow it to remain on the leaf for 5 minutes only. The liquor is then poured from the pots into the cups, the infused leaf being turned over into the hollow of the lid, so that a comparative examination may be made of the samples.

Heavy blending teas are generally obtained at the lower elevations and the lighter coloured liquoring teas, with flavour, at the higher elevations.

The writer wishes to express his indebtedness to the various Superintendents of the tea estates visited for the valuable assistance and advice which was so freely given to him in connection with the cultivation and manufacture of tea as practised in Ceylon.

# RICE STORAGE EXPERIMENTS

BY

H. W. JACK,
*Economic Botanist*

and

R. B. JAGOE,
*Assistant Economic Botanist.*

Malaya is essentially a rice importing country since approximately two-thirds of our consumption of this commodity has to be imported annually from adjacent producing countries to which, fortunately, we have fairly easy access. Local production of rice is inadequate to provide for the requirements of the country, mainly because nearly two-thirds of the population consists of imported labourers for our rubber and tin industries—labourers who, at present, possess no facilities for the cultivation of rice.

In any country dependent, as is Malaya, on outside sources of supply for the staple food of 96% of its population, the possibility of an unforeseen shortage has always to be considered. Among proposals for guarding against any such emergency it was suggested that large quantities of padi should be imported annually and stored for milling locally as required for consumption; but the storing of rice as padi would have necessitated the erection of enormous stores and padi supplies would have been relatively more expensive than rice to purchase, handle and ship.

Moreover, the storage of rice as padi would only deal with half the problem, since Siam rice, the type of rice consumed by the Chinese and forming about half of our total import, is not obtainable in the form of padi.

Further deliberations resulted in the decision to erect an experimental store adjacent to the Department of Agriculture to test the keeping qualities of rice under controlled conditions. This store was completed in November, 1927, the dimensions being 30 x 12 x 10 feet high. It is built of brick and concrete with wooden floors raised four inches off the concrete foundations and has a corrugated iron roof. The building is divided into three self-contained compartments—

(A) Protected from rats with ½ inch mesh wire netting and well ventilated.

(B) Protected from rats and insects; closed by an air-tight door and window and only ventilated on dry days through wire gauze screens.

(C) Protected from rats and insects by wire gauze but well ventilated.

The store was thoroughly dried and ventilated for some months before being stocked with Rangoon parboiled and Siam No. 2 polished rice in sacks as sold by wholesale dealers.

Before proceeding further, it may be mentioned that under commercial conditions rice is not stored locally for more than a month or two. Consequently, local methods of storage mainly aim at keeping the rice, imported in guni bags, protected from the elements. Most small local commercial stores are merely ground floor rooms in brick and cement shop houses in which the bags are piled up to some 12 to 15 feet. The flooring is usually concrete, covered by two-inch planks, on which two or three thicknesses of guni sacking are laid before stacking the bags of rice. Ventilation is usually fair but by no means good and the stores are generally fairly cool. No particular precautions are taken to avoid damage by rats or other pests. This type of store can take some 400—600 bags of rice. At the ports there are a few large stores, and of course, the local mills have a large storage capacity.

In these notes this type of store—the ordinary commercial type—will be referred to as condition D in contrast to condition A, B and C as described above.

## Decrease in Weight of Stored Rice.

In order to determine the effect of storage on the weight of rice (weight being chiefly affected by moisture content and the incidence of pests) samples were drawn at fortnightly intervals for 22 months from each type of rice under the above described four different conditions of storage. The samples were taken at least 6 inches below the surface of the rice in the bags and were always drawn from each type of store on the same day and at about the same hour, on each occasion.

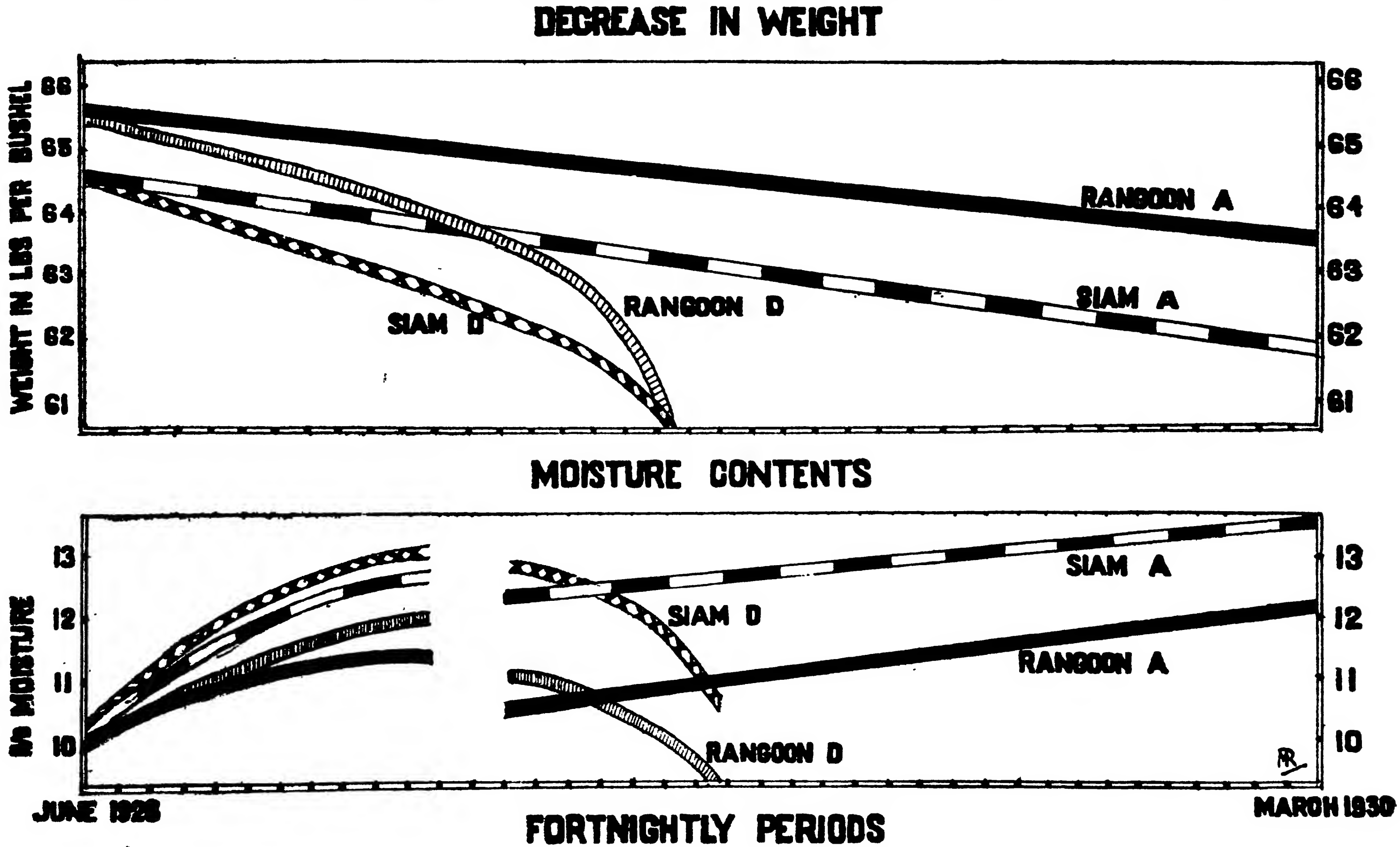
The measurements for comparison were made by using a Brauer's grain tester and tables which shew the weights of the grain samples in lbs. per bushel. This measurement was carefully taken and the error was fairly small, for in a test of the instrument with 23 readings the average deviation from the mean per reading was only .17 lbs. or .26% of the mean weight per bushel (61.05 lbs.).

If it is assumed that the rice was milled two months before the experiment commenced, the rice at the end of the experiment was two years old. Rice is frequently as much as four months old before it is retailed in this country, while it may be kept in some estates' stores for an even longer period. Furthermore, the padi from which the rice is derived may often be several months old before being milled.

The weight of rice when stored under conditions A and C was found to be fairly similar while under condition B, the loss of weight was steady and more rapid. Diagram No. 1 refers to rice stored under condition A and merely shows the trends of weight of rice per bushel and moisture content for the sake of clarity. The diagram shows that with both Siam and Rangoon rice the trends of the decrease in weight are very gradual since the total decrease for twenty months is comparatively small, being 2.2 lbs. per bushel with Siam rice and 1.3 lbs. per bushel with Rangoon rice if the averages are calculated for the first six and last six readings in each case.

The rice stored under condition B was obviously rather damp, and badly

# TRENDS OF WEIGHT AND MOISTURE CONTENTS IN STORED RICE



infested by weevils, but after drying and winnowing was still edible. The rice stored under condition D lost weight regularly but not so rapidly as under condition B until after seven months storage, when sudden deterioration set in with a great increase in weevil population, the rice being absolutely unfit for consumption after 10 months storage.

The diagram shows that under condition A, Rangoon rice is slightly heavier than Siam rice and maintains its superiority in this respect throughout the experiment. Moreover, the Siam rice appears to lose weight very slowly and with the Rangoon rice the decrease in weight is even more gradual.

## Moisture Content of Stored Rice.

At the beginning of this experiment the moisture content was determined by heating the different samples of rice in a steam oven at 100° Centigrade until their weights were constant.

This method required a long and varying length of time, often running into 7 or 8 days and moreover, it appeared that the rice—particularly the Rangoon rice—was undergoing slight chemical change during the drying process. Hence, after seven months, the Agricultural Chemist suggested an alternative method for determining the moisture content which saved much time and did not damage the rice in any way.

An examination of the diagram shows that more moisture was extracted from the rice by the old method than by the new method of drying. This is most marked with the Rangoon rice with which the new method resulted in a drop in the moisture content of about 1% whereas the drop was only about half this amount in the case of the Siam rice.

The Siam rice appeared to give up its moisture more readily and to suffer less from overheating. No doubt some of the moisture extracted from the Rangoon rice by the old method of determination was water absorbed by the rice in the process of parboiling. The new method of moisture determination aimed at giving more comparable results from the two types of rice and consisted in drying the samples at a temperature of 105°C for a period of four hours. This method was found to be the optimum in that it did not result in any discolouring or other adverse effects on the rice, and it was considered that the maximum desiccation had taken place with the minimum of decomposition.

In the diagram, the trends of the moisture contents of Rangoon and Siam rice, as determined by fortnightly analyses, are traced.

Under all conditions of storage, the moisture content of the rices increased rapidly at first, but later the rate of increase steadied down considerably.

The diagram shows that the rate of increase in moisture content was more rapid at first in the case of the Siam rice as compared with the Rangoon rice, but that later the rates of increase were approximately equal. The diagram also shows that the Siam rice yielded more moisture than the Rangoon rice. The variations in the moisture content analyses were small and well within the limits of experimental error.

## Reaction to Weather Conditions.

Observations seemed to indicate that Siam rice reacted more quickly to changes in environment than did Rangoon parboiled rice; consequently, a simple test was made which fully confirmed the observations.

Approximately equal samples of Siam and Rangoon rice were accurately weighed and then placed in desiccators containing fresh calcium chloride. The samples were weighed carefully daily for 3 days and thereafter at intervals of a few days until each sample had reached its minimum weight. The results shewed that Siam rice lost its moisture more rapidly in the first twenty days than Rangoon rice although each type of rice lost its maximum quantity of moisture in the same period of 62 days. After this period the amount of moisture tended to increase with both types of rice.

Similarly, weighed samples of each type of rice were subjected to the same controlled conditions as regards atmospheric moisture, and it was found that Siam rice absorbed moisture more rapidly than Rangoon rice up to a period of 25 days.

Hence, it may be assumed that Siam rice reacts to changes in atmospheric conditions more rapidly than Rangoon parboiled rice.

## Eating Tests.

*Siam Rice.*—Siam No. 2 rice which had been stored for ten months under condition A (and was therefore at least 12 months old) was winnowed and compared with a sample of newly purchased rice. Before cooking the rices, the old could be distinguished from the new by being less clear in colour, very slightly floury as a result of weevil attack, by its drier appearance and by traces of ageing cracks. After cooking, the rices could not be differentiated by appearance or by taste though the smell of the steam of old rice in some cases lacked the freshness of cooked new rice. In order to test the taste of the old rice, nine Malays were given three plates of old cooked rice and three plates of new cooked rice. Not one of the Malays could discern the old from the new rice by taste, by appearance or by any other character since none of them could correctly name the order in which the plates had been arranged. Thus there was no apparent difference between the cooked Siam rice which was a year old and cooked new rice.

Again, samples of Siam No. 2 rice, which had been stored under condition A for twenty-three months, were winnowed, cooked and eaten by Malays who expressed the opinion that the rice was thoroughly good to eat. They had no idea that it was approximately two years old rice for its appearance and taste were not discernible from new rice, though the smell of the steam lacked the freshness associated with new rice.

*Rangoon Parboiled Rice.*—This type of rice, after ten months storage under condition C, was tested by Indians—eleven coolies and three clerks—in a similar manner to that used in testing the Siam rice. Again all the testers failed to

differentiate the new from the old cooked rice either by appearance, smell or taste, although the new rice appeared to the writers to taste more of the parboiling process and the steam of the old cooked rice smelt very faintly of mould.

In the uncooked condition, the old rice was easily identifiable because it was less lustrous than new rice and because it looked drier and shewed faint age cracks.

The same type of rice, after 23 months storage under condition A, was winnowed, and when cooked, was eaten readily by Tamils without any suspicion as to its age, though before cooking the differences between it and new rice of the same type were plainly evident. Thus, Rangoon parboiled rice, stored under good conditions for approximately two years, was found when winnowed and cooked, to be quite edible and hardly distinguishable from cooked new rice.

## Airtight Storage.

Siam and Rangoon rices, which had been in store for 10 months under condition A, were winnowed and placed in empty kerosine tins which had been thoroughly cleaned and aired. From each tin, samples were drawn from which the weights of the rices per bushel were determined by means of a Brauer's grain tester; the tins were then hermetically sealed.

One tin of each type of rice was opened 12 months later and the rice appeared in each case to have undergone no apparent change in appearance or in weight per bushel and when cooked, tasted thoroughly good and could not be differentiated from new rice.

Before cooking, the old rices could be discerned fairly easily from the new because the former looked drier and shewed ageing cracks, but after cooking, the differences were not discernible.

Samples of Siam and Rangoon rice have also been stored in sealed bottles under laboratory conditions for varying periods up to two years without undergoing any perceptible change; in fact, a few samples appear to be quite good after four years bottle storage.

## Fumigation and Airtight Storage.

Siam and Rangoon rices which had already been stored under condition A for 10 months were winnowed and placed in cleaned and aired kerosine tins, each containing over three gantangs of rice. Samples were drawn from each tin in order to determine the weight per bushel for each type of rice and then to each tin 5 c.c. of carbon bisulphide were added before hermetically sealing all the tins. Samples of each type of rice were at the same time placed in bottles and each bottle was treated with .5 c.c. of carbon bisulphide.

A year later, one tin of each type of rice was opened and examined and the rice tested for loss in weight, and it was found that no appreciable change in weight had taken place with either type of rice. The appearance of the fumigated rices differed slightly from rices similarly stored but not fumigated and from new rice, in shewing a pale yellow colouration which disappeared on

cooking. The cooked rices retained no odour of carbon bisulphide, the taste was satisfactory, and the rice was readily consumed by Tamils (Rangoon rice) and Malays (Siam rice).

### Insect Pests.

The Entomologist of the Department of Agriculture examined samples of rices which had been stored for 12 months under the conditions A. B. and C.

His report indicated that insects, mainly weevils, which are by far the most destructive pest of rice, were found in varying numbers in all the samples examined, although under conditions A and C very few insects were found. Under condition B insects were fairly numerous in both types of rice, but whereas species of Rhynchota and Silvanus (*S. surinamensis* and *S. advena*) predominated in the Siam rice, the predominant insect in the Rangoon rice was *Calandra oryzae*, the common rice weevil. Possibly the prevalence of weevils in the Rangoon rice can be explained by the fact that the Rangoon rice, in the bags, was always found to be approximately .5°F. hotter than the Siam rice, and this slight difference in temperature may have produced a damper atmosphere which favoured the multiplication of weevils.

No entomological examination of rice stored under condition D was made, but fortnightly observations shewed that under this condition, both rices were much more severely infested with pests, chiefly weevils, than rices stored under conditions A, B and C.

Moreover, while Siam rice appeared to attract weevils at an earlier stage in storage than did Rangoon rice, ultimately the Rangoon rice shewed the higher infestation.

By winnowing the rices which had been subjected to all conditions of storage for 12 and 23 months respectively, it was found possible to reduce the number of insects in the rice to negligible quantities with very little reduction in the volume of the rice except when stored under conditions B and D, in which cases the damage occasioned by pests was considerable. Thus, under well ventilated conditions, both types of rice suffered less severely from pests than rices stored in poorly ventilated and consequently damper conditions.

### Mycological Examination.

Samples of rice which had been stored under the varying conditions A, B and C for approximately 12 months were examined by the Mycological Division. Only those rices which had been stored under condition B were reported to smell mouldy, although even in this case no definite fungus was found. The rices stored under conditions A and C were free of fungus and did not smell mouldy. The rice stored under condition D was not examined as it was obviously mouldy and clumped by fungus strands.

After approximately 23 months of storage in conditions A, B and C, the remarks already made were still applicable to the rices kept under the various conditions of storage except that the Siam rice under condition C smelt slightly mouldy. Thus, only those rices which were stored under poorly ventilated conditions became mouldy.

## Vitamin "B" Extract.

As regards the nutritive qualities of stored rice, it is the general opinion in Burma that rice stored for longer periods than 4—5 months loses some of its nutritive properties and some authorities even express the opinion that beri-beri is not due so much to polished rice as to mouldy polished rice. We doubt if this theory has any medical support and a preliminary examination of 12 months old rice by Dr. Rosedale of the Medical College in Singapore indicated that there was no material difference in the Vitamin B extract of old and new rice. Moreover, Dr. Rosedale inclined to the opinion that little material gain would result from a chemical study of the ageing of rice stored for periods up to 18—24 months.

Dr. Kondo, an eminent authority on rice storage in Japan, has shown that the Vitamin B content of rice, stored for four years in airtight containers or in an atmosphere of carbon dioxide remains unchanged. (Berichte des Ohara Instituts 1930).

## General.

While some authorities in Burma maintain that it is not possible to store rice with safety for more than 4—5 months, there does not appear to be much unanimity in that opinion for some of the largest millers in Rangoon have been known to store large quantities of rice for 6—8 months. The length of time over which rice can be stored in Burma appears to depend largely on the period of the year during which the milling is done, since rice milled between April and September, that is when the padi is dry, is said to be the best rice for storage purposes and this is in accordance with expectations, because rice which is well dried will undoubtedly suffer less from pests than rice containing a high percentage of moisture. The keeper of one large store in Rangoon stated that, if necessary, he could store rice for a year in good condition, and a Chinese merchant also expressed the opinion that rice would keep better in the equable climate of Malaya than it does in Burma.

While some of the rice mills in this country have fairly large rice storage capacities, rice is only stored therein pending distribution. The period of storage rarely exceeds 3—5 weeks at the outside, though during the rice shortage in 1920—21, rice was kept in stores for a considerably longer period, in one case for over six months.

Similarly, the rice merchants in Malaya do not as a rule store imported rice for more than a month or two at the outside. All their stores are merely designed to protect the rice from the elements, little or nothing being done to prevent ravages by rats or insects.

## Recommendations.

For the satisfactory storage of rice for periods up to two years, stores must be designed carefully to ensure (a) good ventilation, particularly when the air is dry, (b) dryness, (c) coolness, and (d) protection from vermin. The rice should be thoroughly air-dried before being stored so that its moisture content is less than 12% and preferably 10%.

If storage provides all the above mentioned conditions, the problem of protecting the rice from insect pests need cause no grave concern, since if insects are ultimately present—as they will be to a limited extent—they can be removed by winnowing or by washing the rice before it is cooked for food. (Rice eaters habitually wash their rice before it is cooked.) At the same time, where the destruction is required of pests already affecting the rice before it is stored, such destruction can be effected either by fumigation with carbon bisulphide or by exposing the rice to a dry heat which should not exceed 105°C. for a maximum period of four hours—the optimum temperature and a period of exposure being determined by experiment—though a lower temperature would probably be effective.

Normally, rice is more easily handled when stored in bags, but it might be found feasible to utilise airtight storage in large bins or silos either in bags or in bulk. For airtight storage the rice before storage should be well air-dried—preferably by artificial means—and then kept cool. If the rice is intended to be stored for long periods, the airtight containers, if very large, should be provided with facilities for fumigation as an additional method of combating insects.

## Conclusions.

1. Under ordinary local commercial storage conditions, rice is scarcely edible after some eight months storage. It could, however, if well dried and winnowed and then washed, be used for food in case of a rice shortage.

2. Under rat proofed and well ventilated conditions, rice may be stored in quite good condition for two years. It should, however, be winnowed before cooking.

3. Siam rice loses weight more rapidly than Rangoon rice because it is more severely attacked by weevils in the earlier months of storage.

4. Under well ventilated conditions the moisture content of Siam rice increases more rapidly for some four months than does that of Rangoon parboiled rice.

5. After some four months, the rate of increase in moisture content of both rices is approximately equal and gradual, but the Siam rice has, constantly, a moisture content about 1½% higher than Rangoon rice.

6. Under airtight conditions, rice can be kept in good condition for two years (probably much longer).

7. If fumigated with carbon bisulphide at the rate of 5 c.c. per 4 gallons (18 litres) rice can be stored in airtight containers for two years (probably much longer). The carbon bisulphide fumes tend to impart a pale yellow tinge to the uncooked rice. Less of the fumigant would certainly be sufficient to keep the rice free from insect attacks.

8. Rice (in small quantities) can be kept for two years in airtight containers to which one ball of naphthalene has been added per gallon of rice.

9. A preliminary examination shewed no material difference between the Vitamin B extract of rice stored for 12 months in good conditions and that of new rice.

# THE AMERICAN MARKET FOR TUBA ROOT (Derris elliptica)

BY

R. C. ROARK,

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Injurious insects in the United States cause a loss that has been conservatively estimated by economic entomologists at $2,000,000,000 a year. For combating these pests large quantities of insecticides are used. Exact statistics are not available, but not less than 30,000,000 pounds each of lead arsenate and calcium arsenate are yearly consumed. In 1928, the importation of Pyrethrum flowers into the United States amounted to more than 11,000,000 pounds, valued at nearly $2,500,000. Nicotine and other insecticides are used in great amounts also. The market in the United States for insecticides has grown rapidly in the last 20 years and may be expected to continue to grow.

The roots of certain species of Derris have been known for many years to possess valuable insecticidal properties, but Derris has been used only to a limited extent in the United States. This has been due to ignorance concerning its value in controlling specific pests, to fear of its reported toxicity to man and domestic animals and to a lack of knowledge concerning its chemistry. Only recently have the constituents of Derris root been isolated in pure form and carefully studied. A Japanese chemist, Nagai,* isolated rotenone, its most potent insecticidal principle, as early as 1902, but it is only within the past five years that any appreciable progress has been made in our knowledge of the chemical nature of this compound. The structure of rotenone is now being investigated by chemists in Japan, Germany, England, and the United States.† It is reasonable to expect that their efforts will eventually reveal the structure of the rotenone molecule. Whether rotenone can ever be synthesized is a question that must remain unanswered for the present.

Rotenone is a white crystalline material having the empirical formula $C_{23}H_{22}O_6$, and a melting point of 163° centigrade. It contains 1 keto group and 2 methoxyl groups. It is extremely insoluble in water, very slightly soluble in petroleum ether, kerosene and other petroleum hydrocarbons, slightly soluble in methyl, ethyl, n-propyl and n-butyl alcohols, soluble in benzol and acetone and readily soluble in chloroform, ethylene dichloride and trichloroethylene.

At the April, 1930, meeting of the American Chemical Society, W. M. Davidson, an entomologist of the United States Department of Agriculture,

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* J. Chem. Soc. Tokyo, 23 : 740, 1902.

† LaForge and associates, Jour. American Chem. Soc., 51 : 2574, 1929, and 52 : 1088, 1091 and 1102, 1930.

reported that 1 gram rotenone in 300 litres of water (a dilution of 1 in 300,000) effectively controlled the bean aphid (*Aphis rumicis*).

At this same meeting Dr. D. E. Buckingham, a veterinarian of Washington, D.C., presented a paper reporting results of feeding rotenone to dogs, cats, sheep, chickens and other domestic animals. A dog when fed pure rotenone at the rate of 1 grain per pound of body weight manifested no visible symptoms. Chickens that had been fed several grains of rotenone each were unaffected. These chickens were afterwards eaten without causing any ill effects. It may be concluded from these experiments that pure rotenone, separated from the resinous substances and other constituents associated with it in Derris root is harmless to mammals and to chickens when taken by mouth.

Rotenone thus appears to be an ideal insecticide, as it is highly toxic to insects but non-poisonous to man and domestic animals when eaten by them.

Rotenone is also effective as a stomach insecticide. Caterpillars feeding upon vegetation sprayed or dusted with rotenone are killed. Tests indicate that rotenone is more toxic than lead arsenate as a stomach poison to some insects. Rotenone is thus potentially one of the most valuable insecticides and it should be much in demand when it becomes better known.

Derris root varies widely in its rotenone content, the proportion ranging from a few tenths of a per cent. to 5.5 per cent. in commercial shipments. Instead of selling Derris on the basis of ether extract dealers would do well to offer it on the basis of rotenone content. While the ether extract of Derris root includes any rotenone present, it also includes a number of other compounds of less insecticidal value. Clark* has isolated and purified a number of the constituents of Derris root other than rotenone. These include toxicarol, ($C_{23}H_{22}O_7$, yellow crystals, melting point 218—220°C.); tephrosin, ($C_{23}H_{22}O_7$, white crystals, melting point 198°C.); and a compound of the formula $C_{23}H_{22}O_6$, (white crystals, melting point 171°C.) Tests so far made with these compounds against insects show that they are less effective than rotenone as contact insecticides.

## Determination of Rotenone in Derris Root.

The following method has been employed in the Insecticide Division laboratories in assaying commercial Derris root for rotenone:

One hundred grams of dry ground root (20 mesh) is completely extracted in a Soxhlet apparatus with ether. The extract is concentrated to about 25 cc. and transferred to a 125 cc. flask. The original container is washed with three 5 cc. portions of ether, and the combined extract and washings are concentrated to 25 cc. The extract is then set aside for one day to allow the rotenone to crystallize. In order to hasten crystallization the flask is occasionally scratched. The rotenone is then filtered upon a tared Gooch crucible containing a filter paper disc, washed with about 10 cc. of ether in small portions, dried, and weighed.

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* Science, 71 : 396, 1930.

An extract of Derris root would be more acceptable to the trade than crude roots, and the manufacture of such an extract might well be undertaken at the place where the roots are grown. By selling a Derris extract instead of the roots the cost of transportation would be reduced to approximately one-fourth the present rate, and by sending the extract direct to the United States instead of by way of European ports a further reduction in costs would be effected.

We have found acetone to be a convenient solvent for extracting, on a large scale, the rotenone and other constituents of insecticidal value from Derris root. The coarsely ground roots are macerated with the solvent for 24 hours, after which the solution is drawn off, the acetone distilled, recovered and allowed to repercolate through the roots. This is all done in a closed system and very little of the solvent is lost. About 20 to 25 pounds of solid extract are obtained from 100 pounds of high-grade roots. Ether may be similarly employed, but the fire hazard attending its use is much greater than with acetone. Benzol is used by Japanese manufacturers of Derris insecticides in extracting the rotenone.

## Rotenone Occurs in Other Plants.

The Insecticide Division has been making a survey of tropical fish poisoning plants for the purpose of finding materials of value as insecticides. Clark* has shown that the South American plant "cube" (pronounced coó-bay) contains 7 per cent. rotenone. This is a higher percentage of rotenone than has been reported for Derris root. Killip† has identified "cube" as *Lonchocarpus nicou* (Aubl.) D.C. Tattersfield, Gimingham and Morris‡ had previously reported other species of *Lonchocarpus* from British Guiana to contain tuba-toxin (another name for rotenone). Other plants reported to contain rotenone are *Milletia taiwaniana Hayata*§ *Mundulea suberosa Benth*|| and *Ormocarpum*¶.

Species of Derris other than *elliptica* have been shown to possess insecticidal properties which are doubtless due to rotenone. These species include *D. chinensis, malaccensis, philippinensis, polyantha, thyrsiflora* and *uliginosa*. The first named species, *D. chinensis*, has been reported by Takei** to contain 6 per cent rotenone.

It may be possible, by careful selection and breeding, to develop a variety of Derris containing much more rotenone than the species now commercially available. Efforts along this line should yield generous returns.

It would seem that *Lonchocarpus* should thrive in the Federated Malay States and adjoining country, and the introduction of this plant is suggested. At present the roots of *Lonchocarpus* species are not available in commercial quantities, but potentially they are a more valuable source for rotenone than is Derris.

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* Science, 70 : 478, 1929.

† Jour. Wash. Acad. Sci., 20 : 73, 1930.

‡ Ann. Appl. Biol., 13 : 424, 1926.

§ Atsumi and Shimada, Yearbook of Pharmacy 1924, p. 209.

|| Greshoff, Ber. deut. Pharm. Ges. 9: 215, 1899.

¶ Greshoff, loc. cit.

** Biochem. Z. 157: 1, 1925.

## Possible Uses for Rotenone.

Efforts are now being made in the United States to find a substitute for lead arsenate for spraying against the codling moth and other orchard pests. Field tests will be made during the summer of 1930 with rotenone to test its efficacy as a stomach insecticide. If rotenone proves successful in controlling chewing insects a large demand for the product may be expected. The high potency of rotenone as an aphiscidal spray is already established, and there is a large market for it as a contact insecticide. When the desirable insecticidal properties of rotenone become generally known there will be no difficulty in marketing large supplies of it in the United States.

# Selected Article.

## SELECTION OF ROBUSTA COFFEE.*

Mr. Hille Ris Lambers—(See "De Bergcultures" Vol. 3 (1929)—page 1924)—delivered a very instructive lecture on the selection experiments made in Java with Robusta Coffee; of which the following is a review.

The first thing to which attention should be drawn is that fact that the Robusta fields, now in existence in Java, are a mixture of many greatly different types, many of which have come into being as a result of hybridization with Uganda, Quillou and Canephora coffee. In breeding experiments, the chief object is to obtain races which are distinguished by their large yields, power of resisting diseases and pests, good quality of the beans—(size, evenness, colour, flavour and taste)—and easy workability (removal of silverskin etc.). Breeding consequently has to start by selecting those trees in the field that possess these properties in as favourable as possible a combination so that they can serve as mother trees for further breeding. For that purpose, all trees in the field that are found to possess especially advantageous properties are marked with indelible numbers and all observations made are accurately recorded. In order to obtain reliable information on the yielding capacity of these trees, yield records have, of course, to be kept for a number of years.

Descendants of the selected mother trees may be obtained by either vegetative propagation—(budding or grafting)—or by growing from seed.

In the case of vegetative propagation, the properties of the mother plant, and also its power of resisting diseases and pests, are in most cases retained by its descendants. But the character of the stock on to which they have been grafted may make itself felt and in this respect valuable experience has already been obtained in Java. For instance, *Coffee excelsa,* formerly frequently recommended for this purpose, has generally proved to be less serviceable, trees budded on to this stock frequently suffered from too heavy bearing in the first few years. Hybrid 12401 of Robusta x Quillau recommended by Cramer, seems to be serviceable for general use. Some pure Robusta races too, have supplied good stocks. It may also be advantageous to use seedlings from good mother trees as stocks. When a combination of stock and scion does not give satisfactory results, there remains the possibility of sawing off the tree trunk below the point of union and of letting a shoot grow from the stock and in that way obtaining a new tree with, to some extent, satisfactory properties.

When grafted plants have been obtained from buds of a common mother tree, and planted in different spots, careful and long observation will make it possible to come to a reliable conclusion as to the extent to which the good properties

* Translated from "Der Tropenpflanzer," Vol. 33, No. 2, Feb., 1930.

of the mother tree had been due to external conditions, for instance, to especially suitable soil. It can then also be determined for what climatic and soil conditions the clone is best fitted.

When a mother tree is propagated from seed, it should be remembered that with Robusta coffee this usually results from cross pollination and that consequently the progeny of any tree in the field may be from different fathers and the properties of the mother tree may be combined in the most different ways with those of the father tree and with those of the ancestors of both parents. It has, however, been determined by tests that in the case of crossings of different coffee species and varieties, the properties of the mother tree are more prominent; for instance, in a cross between *Coffee robusta* (female) x *C. arabica* (male) the resulting progeny is more like *C. robusta* and in a cross between *C. arabica* (female) x *C. robusta* (male) more like *C. arabica*.

A more even field of young trees can, at any rate, be obtained when cross-pollination is excluded. With a mother tree standing in a field this can be done by building a cover of a close-meshed gauze round it. By this method, however, but few good seeds have been obtained. Better results are obtained by watering the mother-tree abundantly in the dry season when normally no flowers are formed. The effect of this is that about a week later flowers open on that tree and they can, of course, be pollinated only with pollen from that particular tree; care should, however, be taken to remove all flowers opening on that tree after the rains have started as they are liable to be pollinated with outside pollen. In practical work, the procedure usually is to plant, in an isolated position, a separate field, containing only vegetatively propagated descendants of a single common mother tree. In that way, a great quantity of seed from the same clone is more easily obtained. Seedlings grown from such seed may still show considerable difference in properties and only repeated selection will eventually produce seed that will be more or less true to type.

Apart from this, crossings have also been made artificially between good parent trees; those trees among their progeny so obtained that proved to possess good properties, are to be multiplied by vegetative and by sexual propagation.

At present, however, it is not considered advisable to graft on a large scale; many questions, such as the behaviour of such trees at an advanced age and their superiority over trees grown from selected seed, have not yet been sufficiently investigated. All estate directors are, however, advised to make an immediate start with budding experiments. Under certain conditions graftings may be made in existing fields. For instance, it may prove advantageous to cut down poorly yielding trees of Quillou in a damp environment or of Canephora and to graft a bud from a high yielding tree on to a shoot growing from the stump. Such experiments also supply experience as to what types grow best on any particular estate under local climatic and soil conditions.

From the above it may be concluded that coffee selection is energetically and purposefully conducted in Java and it may be expected that these investigations will be of increasing practical benefit in the cultivation of coffee.

# Abstracts.

## BUDDING AVOCADO SEEDLINGS.*

The operation of budding is simple, but must be carried out with unusual care and attention to every detail to ensure success.

Seedlings to be used for budding should be kept in a thrifty, growing condition. They may be budded any time during the season when the sap is flowing freely, after they have attained a diameter of one-half inch. Usually this occurs early in the spring. For budding at this time, well-matured wood from the previous season's growth may be used. After active growth has commenced, suitable buds are not available until new growth has hardened, usually by the latter part of November. At this time budding can again be commenced and continued until late in the autumn. A certain percentage of the buds inserted in autumn will push out and make some growth and will require extra protection during the winter. Only buds put in very late autumn can be counted on to remain dormant until spring.

Ordinarily wood that is well matured with fairly plump buds, that is, wood not hard and yet which does not snap on bending, furnishes the best material for buds. Intimate knowledge of the peculiarities of each variety comes only with practice and observation.

Shield budding, such as is used in the propagation of citrus and deciduous fruits, is the common nursery practice. A "T" incision is made within 2 or 3 inches of the ground, preferably on the south side of the seedling. The bud is cut in the shape of a shield not less than an inch and a quarter in length, and is pushed gently into position. The stock should be in such condition of growth that the bark will slip readily, and will not require lifting by the knife blade, otherwise it is too dry to be used successfully.

The knife blade used for cutting buds should be thin and should be kept at a razor edge. The cut should be made as parallel to the surface of the stick as possible with a single sliding motion: much of the success of budding depends on having the cut uniform, smooth and straight.

After insertion, the bud is immediately wrapped, beginning at the top and working down. Budding cloth is recommended, provided a hard wax is used in its manufacture which will not melt and injure the bud in hot weather. A wax composed of one pound of beeswax and one quarter of a pound of resin is satisfactory.

About three weeks are required for the buds to unite with the stock, during which period they should be examined and the wrap loosened to prevent binding.

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* Reprinted from "Farming in South Africa", Vol. V, No. 49, April, 1930.

Reference: Avocado Culture in California (Bul. 365) University of California. Manual of Tropical and Sub-tropical Fruits—Popenoe.

The top should be pinched back at this time in order to start the bud into growth. From 6 to 8 weeks after budding the wraps may be safely removed. After another month of growth the seedling should be cut back still further, leaving some foliage to take care of the sap flow. The seedling top should not be cut off until the bud has grown at least two feet.

Sometimes if the top is pinched back, as suggested above, to force the bud, it has been found that it is extremely difficult to get the seedling to grow again, in the event of the bud having failed to take, and a second attempt being contemplated. Where this is likely to happen, it is best not to stop the seedling until the bud is actually shooting.

It must be pointed out that it requires considerable skill and patience to bud avocados successfully. Nurserymen in the Transvaal and also in California consider themselves quite fortunate if they obtain a 30 or 40 per cent take.

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## DERRIS OR TUBA ROOT.*

For many years past the people of the Phillipine Islands, Southern China and the Federated Malay States, Borneo and Sumatra, have been using the roots of the low-growing shrub known as *Derris elliptica* for killing fish and insects and as the source of an arrow poison. Some ten or twelve years ago some of the root was brought to America for trial as a possible valuable insecticide. Within the past four or five years Derris has proved to be a very effective poison for a considerable variety of insects. Green apple aphis and the nasturtium aphis can be effectively controlled by spraying with the ground root at the rate of one pound to 20 gallons of water. It destroys mosquito larvae when applied at the rate of one pound to each 1,000 gallons of the water in which the larvae are present. Many other insects are also amenable to the poison contained, but particularly fleas, lice, house flies and the larvae of the warble fly and it is for these latter that Derris is chiefly used at present.

The powder produced by grinding the roots is brown in colour and contains as the active principle, a substance called "Rotenone", $C_{23}H_{22}O_6$, a name which is derived from the Japanese name for the derris plant (viz. Roten.).

No doubt Derris will become more widely used as it becomes better known and after it has received more extended trials as to its effectiveness against other insects. It has already shown itself capable of destroying a great variety of insect life. Reasonable cost, ease of securing and ample supply will be the other factors which will determine to what extent it will become utilised.

Several preparations are on the market under various trade names which contain extracts of Derris as their active ingredient. 'Pulvex' and 'Derrisine' are examples of such.

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*** Reprinted from "Insecticides, Fungicides and Herbicides," by H. L. Fulmer, B.S.A., M. A., Bulletin 351, April, 1930, Ontario Department of Agriculture.**

# Review.

## A GUIDE TO RUBBER ESTATES BOOK-KEEPING AND ACCOUNTS.

BY

E. D. BUTLER, A.C.A.

*Singapore, Printers Ltd., 1930. 74 pp. and Indices.*

As the Author states in the Preface, this volume does not purport to be an instructional book on the theory and practice of book-keeping. The object of the book is to provide an authority to which planters can refer when dealing with matters of book-keeping and accounts on their estates, or when called upon to keep their own estate accounts. The arrangement and conciseness of the contents of the fourteen chapters and the provision of a General Index and Index of Forms and Specimen Rulings achieves the object in view.

The reader is taken through the routine of the double entry system, separate chapters being devoted to the Cash Book, Journal, Check Roll, Ledger, Trial Balance and Balance Sheet, and Profit and Loss Account, interspersed in suitable places with chapters on Coolie Deposits etc., Monthly Statement of Estate Expenditure, Manager's Account Current, Capital and Revenue, Costs, Crop Book, and Office Routine and Filing.

In these days, when cost of the production and market price of rubber are almost synonymous terms, rigid economy in production is essential. Without an adequate system of book-keeping it is impossible to check waste and to realise where further economy is possible. Mr. Butler's book outlines a satisfactory system of standardising accounts which should make it possible for a manager to exercise perfect control over the area under his charge.

D.H.G.

## Miscellaneous.

# MALAYAN AGRICULTURE AT THE INTERNATIONAL MARITIME AND COLONIAL EXHIBITION, ANTWERP, 1930.

The British Government Pavilion, designed by Sir Edwin Lutyens, occupies a commanding position upon an angle of the old city fortifications of Antwerp, and is reached by two bridges spann'ng the moat.

Malaya shares the Colonial Section of this Pavilion with the Gold Coast and Nigeria and His Majesty's Eastern African Dependencies, and occupies an area of 1,690 square feet, or four bays, on the angle facing visitors immediately on their entrance by the East door.

The agricultural exhibits occupy three bays—the fourth being concerned with mining, forestry and native arts and crafts.

The first bay is devoted to oil palm products, tea, coffee, various minor products, coconut products, tapioca, tuba, pineapples and fibres; also to the exhibit of the Rubber Research Institute of Malaya, comprising the scientific side of rubber preparation and the pathology of rubber. The exhibits include the various types of tapping-knives and gouges, metrolacs, hydrometres, the preservatives, coagulants and anti-coagulants, and specimens of latex, latex serum, coagulam and wet sheet. Under pathology of rubber is included specimens of defective rubber and specimens illustrating the various diseases to which the rubber tree is prone, together with a large number of photographs and water colours.

Of the other agricultural products, chief prominence is given to oil palm products and pineapples. These two exhibits are accompanied by special graphs of export statistics, prepared by the Department of Agriculture and displayed in gilt frames. Whole pineapples are displayed in jars, surrounted by pyramids of tinned pineapples under as many packings and labellings as practicable. Invitation cards to view the pineapple exhibit were sent to about one thousand leading provision merchants.

The oil palm and coconut exhibits are accompanied by soaps and other manufactures to illustrate their industrial applications.

The second and third bays contain a comprehensive exhibit staged by the Rubber Growers' Association, illustrative of the leading industrial applications of rubber, viz. Rubber flooring, stair-covering and wall panelling; rubber flowers; sponge rubber and pneumatic mattresses and upholstery; rubber in motor car construction; Wilkinson Process; rubber in machinery; rubber roadways; rubber Wellingtons; domestic appliances; rubber in combination with precious metals; and plantation sole crepe for footwear.

The centre of this section is occupied by an attractive dioramic back-cloth shewing a plantation scene, faced with an exhibit of raw rubber in all its forms and a working model of a battery of estate machinery. At a special counter in one corner fitted with the necessary machinery, an expert gives daily five demonstrations of soleing shoes with plantation crepe, embodying the special feature of employing latex as an adhaesive. Invitations were sent to some 3,000 members of the Belgian shoe trade, inviting them to attend these demonstrations and a very gratifying degree of interest has been evoked.

The walls of the bays are suitably decorated with photographs, flags and arms of the Federated Malay States and arms of the various States.

The effect of the whole stand is colourful in the extreme and the general lay-out has undoubtedly achieved its main object in impressing upon the visitor some notion of the tremendous fertility of Malaya and its multitudinous resources.

A portable projector is proving highly useful for shewing views of Malayan scenes and industries. Each picture is projected on a frosted glass screen for about five seconds, allowing time for the passers-by to read the caption, but sustaining the movement sufficiently to attract attention.

In addition to a supply of the Agency's regular publications, the stand is distributing two pamphlets specially prepared for exhibition, viz. "Agriculture," (being an abridged edition of the regular pamphlet prepared by the Department of Agriculture), and "Some Notes on the Preparation of Rubber, its Defects and Diseases," compiled by the Rubber Research Institute. These, together with the Malayan Information Agency's brochure on Pineapple Cultivation in Malaya, (also prepared by the Department of Agriculture) have been printed in English, French and Flemish.

There was such a rush for pamphlets in the early days of the Exhibition that considerable difficulty was experienced in controlling distribution. Later, precautions were taken and only genuinely interested enquirers were supplied.

The proportion of popularity of the booklets seems to be approximately 60% "Agriculture," 25% "Pineapples," and 15% "Notes on the Preparation of Rubber." The demand for Flemish, French and English versions of each are probably in about the same proportion. It must be remembered that the pineapple booklet, unlike the others, is illustrated; and it should be added that the majority of those taking the Rubber Research Institute's pamphlet, who are mainly technical enquirers or serious students, are emphatic in its praise.

The Publicity Officer of the Malayan Information Agency—from whose report for the first two months of the Exhibition the present account is written—comments on the results to date. He points out that as the Exhibition has only been running for two months, it is early to attempt such an estimate. It must suffice, therefore, to indicate the tendencies up to the present.

Results in the case of all exhibitions fall into two divisions—general educative propaganda and actual business enquiry.

Regarding the former division, check figures of the number of visitors are

in themselves a sufficient answer. On ordinary week-day mornings the attendance is moderate, as might be expected, though visitors at this time of day are generally of a fair intellectual level and provide the bulk of the trade enquiry. In the afternoon, the numbers are usually increased about tenfold. On Saturdays, Sundays and Festival days, the crowd swells to truly enormous dimensions, and on more than one occasion the check figures have shown that the public has been passing through the pavilion, between the hours of 2.30 p.m. and 6 p.m. at a steady rate of nearly 20,000 to the hour. Although the majority of such large crowds are not taking an intellectual interest in the exhibits, it seems permissible to hope that some thousands of people, when the name of Malaya comes to their attention in the future, will connect it with the wide diversity of products they were shown on the Malayan Stand at Antwerp. Moreover, the fact that, apart from Malaya, the only territories exhibiting in the Colonial Section are the Gold Coast and Nigeria and His Majesty's Eastern African Dependencies, must surely tend to concentrate public attention upon Malaya in a greater degree than would have been the case had a larger number of countries been represented.

It seems to be universally admitted that the Malaya Stand is particularly noteworthy as being bright, decorative and informative, and the officials both of the British Commission and the Exhibition Committee have been most emphatic in its praises. The indications at present are that Malaya will derive considerable benefit—both direct and indirect—by participation in this important exhibition.

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# AGRICULTURAL SHOWS IN AUGUST, 1930.

## Agri-Horticultural Show, Kuantan.

A Show for the Districts of Pekan and Kuantan was held at Kuantan on the 28th August, 1930. The Committee decided to dispense with entrance fees and this factor, combined with careful arrangements for collecting and forwarding exhibits, resulted in a very satisfactory number of entries, many of which attained a good standard of quality. In the Cereals Section there were over 1,500 exhibits of padi and rice together with a good collection of maize. The Gold Medal presented by His Highness the Sultan of Pahang, for the best exhibit of padi, was awarded to a competitor from Pekan District for a sample of the pedigree strain Radin 2. The Fruit, Vegetable and Arts and Crafts Sections were also good, a creditable share of prizes for vegetables being secured by exhibits from school gardens. The Vegetable Section was well supported by Chinese as well as by Malays, though the latter predominated among the winners of prizes for fruit. The Livestock Section included a number of cattle and buffaloes with some sheep and goats.

The Show was opened by His Highness the Sultan, assisted by the Honourable the British Resident of Pahang. The numerous visitors and exhibitors took a keen interest in all sections and also in the instructional exhibits prepared by the Health Department, the Rubber Research Institute and the Department of Agriculture.

## Agricultural Show, Perak North, Taiping.

An Agri-Horticultural Show was held at King Edward VII School, Taiping, on the 23rd and 24th August.

The Show, which was opened by H.H. the Sultan of Perak, was fairly well attended, especially by Malays and Chinese, who displayed considerable interest in the Departmental exhibits. Unfortunately there was heavy rain for most of the afternoon on both days, consequently the Show was not so well attended as usual.

The exhibits in the agricultural section were of good quality although the entries in some sections were not so numerous as usual. Fruits and vegetables were well represented and the collections of vegetables shown from School gardens were good. In the Cereal Section there were a large number of exhibits of both padi and maize.

The Poultry Section was well supported and contained exhibits of local ducks, geese and fowls of mixed breed.

The Horticultural Section was disappointing, there being only two or three exhibits staged; there was, however, the usual fine display of vegetables and flowers from Maxwell's Hill.

The Arts and Crafts Section was well supported and there were some fine examples of basketry, embroidery and other work, including silver-ware.

Educational exhibits were staged by the Health branch of the Medical Department, the Rubber Research Institute and the Department of Agriculture. There was also a display of articles made by convicts at the Convict Establishment, Taiping.

The Rubber Research Institute exhibit dealt with rubber diseases, faults in the preparation of rubber; soils and manures.

The Department of Agriculture staged exhibits of Tea from the Government Plantations at Serdang and Cameron's Highlands; oil palms—fruits and oils with explanation of their uses; faults in the preparation of copra; pure high yielding strains of padi; insect pests of padi and the coconut palm; diseases of the oil palm and destruction of rats. Departmental publications were also obtainable.

# FROM THE DISTRICTS.

## The Weather.

Very dry hot weather continued throughout August with some showers towards the end of the month, when a break in the long drought appeared imminent.

## Remarks on Crops.

*Rubber.*—The price declined again during the month, smoked sheet from small holdings selling for $15 to $19.50 a pikul and unsmoked sheet for $12 to $17.50 a pikul. The number of untapped holdings increased slightly. More tapping coolies were dismissed, while many others were given a half share of the daily production in place of the usual daily contract rate of 12 or 13 cents per kati of dry rubber. As was to be expected, the dismissal of tapping coolies has resulted in the appearance of mouldy rot disease in some previously healthy areas where coolies dismissed from infected holdings have obtained employment.

*Padi.*—In Kedah, owing to persistent dry weather, planting is two months late and it is feared that the yield will be adversely affected. In Krian the land was being cleared, except in the mukims of Selinsing, Gunong Semanggol and part of Briah, where no water was available. In other parts of the country most areas with an adequate supply of irrigation water had been planted up by the end of the month. In many areas, however, notably in Province Wellesley, the soil was so dry that planting was impossible. In such areas nurseries have often become too old for transplanting and new nurseries will have to be sown. Consequently planting will be very late and yields will be liable to suffer.

Outbreaks of army worms, *spodoptera mauritia*, have been common in nurseries and even on planted padi under dry conditions. The caterpillars have usually been heavily parasitised and have in many cases disappeared without doing very serious damage, but in some instances hand collecting and other control measures have been necessary. As is usual in a dry padi season, other pests such as "Kutu Bruang" (the Pentatomid bug *Scotinophora coarctata*) and stem borers, mainly Diatraea and Sesamia, have also been in evidence.

*Coconut.*—The price of copra declined again to $4.50—$5.50 a pikul except in Province Wellesley where prices ranged from $6.25—$7.30. In the coastal copra-making areas nuts varied from $1.00 to $1.50 a hundred. In inland Districts prices remained about the same as in July.

Palms have continued to crop well in the Province. In Bagan Datoh District the drying up of the drains has deprived estates of their usual means of conveying nuts to the factories.

*Coffee.*—The price of coffee has now fallen to about $16—$18 a pikul. Inspite of the low price, however, a few new areas are being planted up in Pahang, while in Batang Padang District of Perak, Chinese are planting mixed coffee and rubber.

*Tea.*—An area of 500 acres has been alienated on lease for tea cultivation in Lower Perak District. It is expected that part of the land will be opened this year.

*Tobacco.*—In Province Wellesley a nursery bed has been prepared for tobacco seed obtained from the Government Experimental Plantation, Serdang, in order to provide interested Chinese small holders with seedlings for trial.

*Gambier.*—The gambier market has strengthened recently and gambier plantations in Temerloh District of Pahang have recommenced work following a long stoppage. The price of cube gambier at present is stated to be $15 to $16 a pikul.

*Pineapples.*—In Singapore pineapples have been scarce at the factories and the season may now be considered as finished.

*Fruit.*—The durian and mangosteen, crop had practically finished by the middle of the month, but supplies of rambutan, langsat, rambei and mata kuching were available in most localities. These supplies were, however, rather limited, the fruit season generally having been disappointing, probably owing to the prevailing dry weather.

In Negri Sembilan many fruit trees were in flower, but in different areas in the same district there was a great variation, some trees being in flower whilst others had a crop of fruit.

## Notes of Demonstration Stations and Padi Test Plots.

Work progressed normally on all stations and plots, except the padi test plot at Bukit Merah in Province Wellesley where planting has been rendered impossible up to the present by the prevailing drought. The Padi Inspector's Quarters, Office and Store are in course of erection on this plot.

*Kedah Rice Experiment Station.*—A new station 50 relongs* in area is being established at Telok Chengai in Kedah. Nurseries have been planted with 14 imported and 4 local strains of padi. Ploughing was in progress during the month and other fundamental work had been undertaken.

At the Kuang Test Plot in Selangor a heavy infestation of the stem borer, *Sesamia inferens,* caused appreciable damage. Attacked plants were destroyed by fire and replaced by splitting up healthy plants of the same variety, there being no more seedlings available. The padi at the Temerloh Plot in Pahang was suffering somewhat from shortage of water.

*Kuala Lipis Demonstration Station.*—Four varieties of sweet potato, two varieties of maize and a plot of Red Gourd were harvested. Yields in all cases were low owing to the drought. Local Red No. 1 for the second time proved the best of the sweet potato varieties. Two plots of Sorghum, var. Barbuda, planted early in July showed uneven growth.

## Plant Distribution.

The distribution of pedigree strains of padi to planters in Larut District was

completed. In Perak South greater and lesser yams, Natal White Horse Tooth Maize, ginger and sorghum were distributed to 41 schools and seed of *Centrosema pubescens* was given to the penghulu of Blanja while in Negri Sembilan the yams of the two above mentioned varieties and seed of sweet corn and cantaloupe were distributed.

## Home Gardens.

Home gardens are the logical outcome of school gardens and it is satisfactory to record that some school pupils are forming their own home gardens in Malacca and Province Wellesley. The Junior Agricultural Assistant in Jasin District of Malacca, who has been encouraging this development since the beginning of the year, has met with some success and induced pupils from seven schools in his district to devote spare time to their own vegetable gardens. In some cases the scholars have been able to obtain seed from the school gardens. This movement is being encouraged by the promise of prizes for the best gardens.

## Rats.

In Province Wellesley rewards were paid for 125,081 rats' tails and 35,638 poison balls were distributed. In Krian tails collected amounted to 217,431 and 28,650 poison balls were distributed.

Elsewhere the sale of rat traps at cost price has been maintained, while in Selangor a number of poisoned balls have been prepared for free distribution. In Malacca action has been taken to increase the efficiency of the rat campaign.

# DEPARTMENTAL NOTES.

## The Director of Agriculture visits Negri Sembilan.

The Director accompanied the Committee for the Extension of the Cultivation of Rice in Malaya—of which he is Chairman—on a visit to Negri Sembilan from 25th to 27th August, 1930 inclusive.

## Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at Kuala Lumpur on July 17th, 1930, at which the progress of the work of the Department of Agriculture was reviewed and certain important matters dealt with in detail. The following notes indicate the subjects considered by the meeting.

*Padi Yield Improvement.*—With the co-operation of the District Officer, Krian, efforts have been intensified this year to induce the cultivators to plant special high-yielding strains of padi obtained as a result of selection work at the Titi Serong Rice Experiment Station, Krian. The Committee was informed that hybridisation work has been added to the pure line selection work, with a view to obtaining further improved strains of padi. Work on padi selection has been extended to Malacca, where a padi experiment station has been organised, while steps are being taken to undertake similar work in Kedah.

*Manuring of Padi.*—Progress was reported in relation to investigations concerning the manurial requirements of rice, which were being carried out in specially constructed tanks. The object of this work is to determine the actual feeding requirements of padi under controlled conditions. Details were also given concerning the manurial experiments with padi in the field which are being carried out in various parts of the country.

*Coir Fibre.*—The Committee considered the possibility of establishing the local manufacture of coir fibre. The subject was investigated by the Agriculturist during his recent visit to Ceylon. From the information available, it does not appear that the establishment of the industry in Malaya was likely to prove successful.

*Re-organisation Scheme.*—A scheme for the re-organisation of the Department, prepared by the Director of Agriculture, was considered in detail by the Committee at the request of the Chief Secretary to Government. The Committee, after exhaustively examining the various proposals, recommended that it should be adopted by Government.

*Coconuts and Oil Palms.*—The Committee considered a report on the research work on coconuts and oil palms carried out by the Department during the previous six months. It was decided that the report, with certain omissions, should be communicated to the press.

*Padi Stem Borers and Locusts.*—The Committee reviewed the progress made

in relation to research work on padi stem borers carried out by the Department in the Krian District and at headquarters.

The present position in relation to locusts was explained, it being pointed out that entomological authorities considered that the change from the solitary to the swarm phase by these insects occurred as a time function. A careful watch was being kept on the locusts recently discovered in Negri Sembilan. In order to deal with such swarms, if they materialised, flame throwers of the type which had proved successful in Palestine, had been ordered by cable.

*Pineapple Experiment Station.*—The Committee was informed that an area of 30 acres situated in the centre of the pineapple growing area in Singapore had been obtained for the purpose of establishing an experiment station for the investigation of the manurial and cultural requirements of the crop, and also in order that the varieties of pineapples might be closely studied.

*Propaganda Van.*—The progress of the work in connection with the organisation of a propaganda van which would tour the country displaying cinema films and agricultural exhibits and disseminating general agricultural information among smallholders, was considered by the Committee.

*Coconut Palm Pests.*—Following the suggestions made at the last meeting, the Committee was informed that work has commenced on the preparation of a manual on the principal insect pests of the coconut palm and the methods of controlling them. The work would be couched in simple language and would constitute a handy work of reference for coconut planters.

*Development of the Tea Industry.*—In pursuance of a recommendation of the Special Sub-Committee on Tea, the Government selected Mr. E. A. Curtler, Assistant Agriculturist to visit Ceylon, Assam and Southern India with a view to studying tea research work. This officer was at present on this tour. On his return he will be placed in charge of the Experiment Station at Cameron's Highlands, where it is proposed considerably to extend the departmental experiments on tea.

Other matters discussed by the Committee were the statistical services of the Department, derris root as an insecticide, the operation of the oil palm factory at Serdang, experiments on the storage of rice carried out by the Department and projected work on the standardisation of fungicides for use in the treatment of bark diseases of rubber trees.

The Committee asked that information should be obtained concerning the whale oil industry, the development of which had resulted in the entry of refined whale oil in the market in competition with coconut and other edible oils.

## Appointment.

Mr. G. H. Corbett, Entomologist, has been appointed Consulting Entomologist, Institute for Medical Research, F.M.S. from June 1st, 1930.

## Leave.

Major C. D. V. Georgi, O. B. E., Acting Agricultural Chemist, returned from leave of absence on 21st August, 1930.

# MARKET PRICES.

## August, 1930.

*Rubber.*—The average price of rubber in Singapore for the month was 15.55 cents per lb., compared with 17.97 cents for July. The highest price recorded was 16½ cents per lb. on August 1st, while the lowest was 14⅞ cents per lb. on 19th August. The average London price for August was 4.84 pence per lb., compared with 5.66 pence for July. The highest price recorded in London during the month was 5 5/16 pence per lb. on August 6th: the lowest, 4 5/16 pence per lb. on 22nd August.

*Copra.*—The average Singapore prices for the month were $6.89 per picul for F.M. quality and $7.11 per picul for S.D. quality, compared with $7.39½ and $7.77½ in July. During the past few weeks, larger supplies have come forward although prices have been slowly declining. At the end of August the market was rather steadier.

*Gambier.*—Singapore average prices for August were Block $9.40 per picul, cube $ 14.54 per picul. The previous month's averages were $8.22½ and $15.55 respectively.

*Nutmegs.*—Average prices in Singapore in August were:—110 per lb. $25.62, 80 per lb. $30 per picul. The previous month's corresponding figures were $30.60 and $34.60.

*Mace.*—Siouw averaged $62.70 per picul; Amboina $33.17 per picul on the Singapore market.

*Pepper.*—Singapore average prices were:—Black $22.09; White, Rio and Sarawak, $30.81; Muntok, White $30.17 per picul. In July the average prices were :—Black $27.62½; White $39.62½. Supplies are coming in freely and a comparatively large volume of business is passing.

*Sago.*—Singapore average price for August were for Flake, small, fair, $6.45½ per picul compared with $5.82 in July; Flour, $3.04 per picul. Market is somewhat firmer.

*Tapioca.*—August average prices in Singapore were:—Flake, small, fair $3.86 against $4.28½ in July: Pearl, medium $5.75 per picul: Pearl, small, fair $5.50 per picul compared with the previous month's average of $5.72½. Supplies have been ample. The market is quiet with moderate transactions.

*Pineapples.*—Average Singapore prices; 1½ lb. cubes and 1½ lb. sliced flat $3.60 per case; 1½ lb. sliced tall $4.18 per case. London buyers shew little interest in consequence of which the market is dull.

*Cloves.*—Average prices quoted in Singapore: Zanzibar $52.66; Amboina $59.66 per picul.

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The above market prices are based on the daily cabled London quotations and the Singapore quotations for rubber; on the Singapore Chamber of Commerce Market Reports covering the period 28th July to 23rd August and on other local sources of information.

1 picul = 133 1/3 lbs.

The dollar is fixed at two shillings and four pence.

# MALAYA RUBBER STATISTICS.

## STOCKS OF RUBBER INCLUDING LATEX AND REVERTEX HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORT AND EXPORT FIGURES, AND ESTIMATED FIGURES OF THE PRODUCTION OF ESTATES OF LESS THAN 100 ACRES, FOR THE MONTH OF JULY 1930, IN DRY TONS.

| Territory | Stocks at beginning of month | | | Production by estates of 100 acres and over | | Production by estates of less than 100 acres (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | during the month | | during the year 1930 | | during the month | | during the year 1930 | | | | |
| | Ports | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | Foreign | From Malay States | Foreign | From Malay States | Foreign | Local | Foreign | Local | Dealers | Estates of 100 acres and over | Ports |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **MALAY STATES** | | | | | | | | | | | | | | | | | | |
| **Federated Malay States** ... ... | ... | 8,551 | 13,344 | 13,876 | 74,479 | 9,646 | 64,631 | Nil | 5 | Nil | 42 | 14,819 | 5,452 | 103997 | 36,718 | 9,831 | 15,320 | ... |
| **Johore** ... ... | ... | 2,297 | 4,698 | 3,863 | 22,771 | 3,881 | 27,509 | Nil | 3 | Nil | 12 | 976 | 6,759 | 6,641 | 44,591 | 2,043 | 4,964 | ... |
| **Kedah** ... ... | ... | 325 | 2,146 | 2,385 | 12,603 | 1,243 | 8,719 | 8 | Nil | 30 | Nil | 879 | 2,569 | 4,747 | 16,679 | 418 | 2,241 | ... |
| **Perlis** ... ... | .. | 11 | 10 | 7 | 57 | 13 | 101 | Nil | Nil | Nil | Nil | Nil | 24 | Nil | 173 | 7 | 10 | ... |
| **Kelantan** ... ... | ... | 111 | 51 | 103 | 1,606 | 637 | 2,770 | 4 | Nil | 26 | Nil | 101 | 503 | 458 | 4,001 | 144 | 158 | ... |
| **Trengganu*** ... | ... | 55 | 50 | 126 | 822 | 63 | 411 | Nil | Nil | Nil | Nil | Nil | 189 | Nil | 1,234 | 55 | 50 | ... |
| **STRAITS SETTLEMENTS** | | | | | | | | | | | | | | | | | | |
| **Malacca** ... ... | ... | 2,082 | 1,601 | 1,356 | 7,857 | | | Nil | 1,347 | Nil | 10,010 | 3,433 | | 25,747 | | 2,328 | 1,175 | ... |
| **Province Wellesley** | ... | 92 | 571 | 621 | 2,869 | | | | | | | | | | | 121 | 733 | ... |
| **Dindings** ... ... | ... | 57 | 143 | 103 | 628 | † 2,621 | 20,941 | 698 | 3,702 | 5,921 | 22,946 | 5,027 | Nil | 38,399 | Nil | 120 | 172 | ... |
| **Penang** ... ... | 1,398 | 4,322 | 16 | 12 | 71 | | | | | | | | | | | 4,869 | 15 | 1,524 |
| **Singapore** ... | 2,865 | 30,448 | 368 | 252 | 1,555 | | | 9,722 | 10,439 | 67,330 | 70,386 | 18,770 | | 143,344 | | 31,099 | 376 | 4,474 |

### ANALYSIS OF COLONY AND FEDERATED MALAY STATES DEALERS' STOCKS AT END OF MONTH, IN DRY TONS.

| Class of Rubber (20) | Federated Malay States (21) | Singapore (22) | Penang (23) | Province Wellesley, Dindings and Malacca (24) | Johore (25) | Gross total (26) |
|---|---|---|---|---|---|---|
| Smoked sheet ... | 7,164 | 15,189 | 3,546 | 1,532 | 891 | 27,822 |
| Crepe ... ... | 644 | 13,865 | 1,050 | 728 | 253 | 16,540 |
| Unsmoked sheet ... | 895 | 2,045 | 773 | 309 | 503 | 6,049 |
| Scrap and lump ... | 1,128 | | | | 396 | |
| Total all Grades ... | 9,831 | 31,099 | 4,869 | 2,569 | 2,043 | 50,411 |

*Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated August 11. The ratio of the reduction on wet rubber is taken to be 25% applicable to wet stocks at the ports of Singapore and Penang.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I. & E. 5, dated August 5, reduced to dry weight by the percentage for July in Note 3; (*S.S. Gazette* Notification No. 1603/1930).

6. Foreign exports of each State and Settlement are those published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I and E. 4, dated August 5, (Appendix IV to Monthly Trade Return).

*7. Stocks and production in Trengganu are estimated from figures supplied by the Commissioner of Lands.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.

†9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the Columns comprising it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

J. I. MILLER, M.C.S.,
*Acting Registrar-General of Statistics, S.S. and F.M.S.*

Singapore, August 18, 1930.

## SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS, FOR THE MONTH OF JULY, 1930.

### NEW SEASON COMMENCING.

| State | District | Acreage of Padi Land | Acreage planted | Percentage 4 to 3 | Gross Crop | Crop per Acre 6 to 4 | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | Gantangs | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Perak** | Perak North : | | | | | | |
| | Krian | 53,250 | ... | ... | ... | ... | About half of the nurseries sown. Lack of water delaying sowing. |
| | Larut | 8,525 | ... | ... | ... | ... | Drought holding up planting. |
| | Selama | 3,450 | ... | ... | ... | ... | Some sowing done—drought causing de lay. |
| | Kuala Kangsar | 13,997 | ... | ... | ... | ... | Only 200 acres planted. Preparation for sowing and planting in hand. |
| | Upper Perak | 3,739 | ... | ... | ... | ... | Nurseries sown and land being prepared for planting. |
| | Perak South : | | | | | | |
| | Six mukims | 14,187 | ... | ... | ... | ... | Preparations for planting generally in hand. In some mukims nurseries sown and planting commenced. |
| | | 97,148 | ... | ... | ... | ... | |
| **Pahang** | West : | | | | | | |
| | Temerloh | 12,311 | ... | ... | ... | ... | Transplanting in hand. |
| | Raub | 5,112 | ... | ... | ... | ... | do. |
| | Kuala Lipis | 5,576 | ... | ... | ... | ... | do. |
| | Bentong | 783 | ... | ... | ... | ... | do. |
| | | 23,782 | ... | ... | ... | ... | |
| **Negri Sembilan** | Seremban | 4,904 | ... | ... | ... | ... | Transplanting started. |
| | Kuala Pilah | 18,010 | ... | ... | ... | ... | Preparing Sawah. |
| | *Port Dickson | 159 | ... | ... | ... | ... | Transplanting started. |
| | Jelebu | 3,116 | ... | ... | ... | ... | Transplanting almost completed. |
| | Tampin | 2,609 | ... | ... | ... | ... | Transplanting started. |
| | Rembau | 7,897 | ... | ... | ... | ... | Preparation of sawah completed. |
| | | 36,695 | ... | ... | ... | ... | |

* This area is smaller than that previously published due to the excision of land now regarded as dry padi land of which 450 acres have been planted.

## SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS, FOR THE MONTH OF JULY, 1930.—(Continued).

| State or Settlement (1) | District (2) | Acreage of Padi Land Acres (3) | Acreage planted Acres (4) | Percentage 4 to 3 (5) | Gross Crop Gantangs (6) | Crop per Acre 6 to 4 (7) | Remarks (8) |
|---|---|---|---|---|---|---|---|
| Selangor | Ulu Langat | 2,670 | ... | ... | ... | ... | Transplanting started. |
| | Kuala Lumpur | 797 | ... | ... | ... | ... | do |
| | Ulu Selangor | 1,205 | ... | ... | ... | ... | do |
| | Kuala Selangor | 18,564 | ... | ... | ... | ... | do. |
| | | 23,236 | ... | ... | ... | ... | |
| Straits Settlements | Malacca, Central | 16,473 | ... | ... | ... | ... | Transplanting commenced. |
| | Alor Gajah | 11,239 | ... | ... | ... | ... | Sowing of nurseries in progress. |
| | Jasin | 5,756 | ... | ... | ... | ... | Planting in Progress. |
| | | 33,468 | ... | ... | ... | ... | |
| | P. Wellesley, North | 18,560* | ... | ... | ... | ... | Planting in progress—retarded due to lack of rain. |
| | Central | 10,539 | ... | ... | ... | ... | Clearing in progress but land still dry. |
| | South | 4,643 | ... | ... | ... | ... | Progress being made in irrigated area only. |
| | | 33,748 | ... | ... | ... | ... | |
| | Penang | 4,000 | ... | ... | ... | ... | |
| | Singapore | nil | ... | ... | ... | ... | |

* 350 acres of dry padi not included in this total.

N.B.—The figures given in the latest return under column 3 may be accepted as more accurate than any given in previous returns.

# METEOROLOGICAL SUMMARY, MALAYA. JULY, 1930.

| Locality | Air Temperature in degrees Fahrenheit: Means of A. Max. | B. Min. | Mean of A and B | Absolute Extremes: Highest Max. | Lowest Min. | Lowest Max. | Highest Min. | Earth Temperature: At 1 foot | At 4 feet | Rainfall: Total | | Most in a day: Amt. | Number of days: Precipitation* | Precipitation, 1mm. or more | Thunder-storm | Thunder heard | Fog morning obs. | Gale force 8 or more | Bright Sunshine: Total | Daily Mean | Per cent | Length of Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | °F | °F | °F | °F | °F | °F | °F | in. | mm. | ins. | | | | | | | hr. | hr. | % | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 90.4 | 71.6 | 81.0 | 95 | 69 | 85 | 73 | 82.9 | 83.6 | 1.17 | 29.7 | 0.53 | 6 | 3 | 2 | 10 | 1 | | 202.15 | 6.52 | 52 | 12.3 |
| Bukit Jeram, Selangor ... | 90.4 | 72.8 | 81.6 | 93 | 70 | 88 | 75 | 87.3 | 88.2 | 0.92 | 23.4 | 0.52 | 4 | 4 | 1 | 15 | ... | | 247.10 | 7.97 | 65 | 12.3 |
| Sitiawan, Perak ... | 90.9 | 72.3 | 81.6 | 94 | 68 | 85 | 75 | 84.8 | 84.7 | 2.46 | 62.5 | 1.53 | 8 | 5 | 4 | 15 | ... | | 236.75 | 7.64 | ... | .. |
| Kroh, Perak ... | 86.7 | 69.5 | 78.1 | 90 | 66 | 77 | 73 | 81.2 | 83.1 | 4.97 | 126.3 | 1.28 | 14 | 10 | .. | 3 | 1 | | 201.65 | 6.50 | ... | ... |
| Temerloh, Pahang ... | 90.4 | 72.4 | 81.4 | 94 | 68 | 84 | 75 | 83.2 | 85.6 | 1.78 | 45.2 | 1.06 | 8 | 6 | ... | 13 | 11 | | 214.00 | 6.90 | 56 | 12.3 |
| Kuala Lipis, Pahang .. | 89.6 | 72.0 | 80.8 | 93 | 69 | 85 | 74 | 84.2 | 84.1 | 4.66 | 118.4 | 1.81 | 9 | 9 | 8 | 14 | 19 | | 210.55 | 6.79 | ... | ... |
| Kuala Pahang, Pahang ... | 87.3 | 74.7 | 81.0 | 91 | 72 | 86 | 78 | 86.2 | 86.7 | 6.27 | 159.3 | 3.15 | 13 | 8 | 9 | 18 | ... | | 251.10 | 8.10 | 66 | 12.3 |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 72.3 | 59.8 | 66.1 | 76 | 59 | 66 | 62 | ... | ... | 3.41 | 86.6 | 1.15 | 11 | 9 | 4 | 17 | 4 | | 189.70 | 6.12 | 49 | 12.4 |
| Cameron's Highlands, Tanah Rata | 73.0 | 54.4 | 63.7 | 76 | 50 | 69 | 60 | 69.8 | 69.7 | 2.89 | 73.4 | 1.04 | 11 | 9 | 4 | 17 | 4 | | 174.50 | 5.63 | 45 | 12.4 |
| Fraser's Hill, Pahang ... | 73.4 | 62.5 | 67.9 | 77 | 60 | 69 | 64 | 70.3 | 71.3 | 3.52 | 89.4 | 1.02 | 15 | 11 | 1 | 8 | 13 | | 181.55 | 5.85 | 48 | 12.3 |
| Mount Faber. Singapore ... | 88.5 | 77.7 | 83.1 | 92 | 71 | 86 | 80 | 83.5 | 84.3 | 5.41 | 137.4 | 2.02 | 10 | 8 | 2 | 10 | ... | | 267.20 | 8.62 | 71 | 12.2 |
| Butterworth, Province Wellesley | 88.5 | 74.5 | 81.5 | 90 | 72 | 86 | 77 | 85.7 | 84.7 | 3.83 | 97.5 | 1.60 | 10 | 7 | 1 | 6 | ... | | 212.70 | 6.86 | ... | ... |
| Bukit China, Malacca ... | 85.8 | 74.0 | 79.9 | 88 | 68 | 83 | 76 | 83.6 | 84.7 | 8.56 | 217.4 | 2.30 | 13 | 10 | 4 | 7 | ... | 3 | 250.40 | 8.08 | 66 | 12.2 |
| Kluang, Johore ... | 88.8 | 71.0 | 79.9 | 91 | 68 | 85 | 74 | 82.2 | 82. | 4.75 | 120.7 | 1.80 | 15 | 13 | 15 | 11 | ... | | 216.00 | 6.96 | 57 | 12.2 |
| Bukit Lalang, Mersing, Johore... | 89.3 | 72.8 | 81.0 | 91 | 70 | 86 | 75 | 82.1 | 82.1 | 6.05 | 153.7 | 1.83 | 19 | 16 | ... | 22 | 1 | | 226.65 | 7.31 | 60 | 12.2 |
| Alor Star, Kedah ... | 88.5 | 74.7 | 81.6 | 91 | 73 | 84 | 77 | 86.5 | 86.6 | 4.25 | 108.0 | 1.36 | 16 | 10 | ... | 19 | ... | | 211.25 | 6.81 | ... | ... |
| Kota Bharu, Kelantan ... | 89.5 | 73.9 | 81.7 | 92 | 71 | 85 | 77 | 85.3 | 85.0 | 5.85 | 148.6 | 0.76 | 15 | 13 | ... | 18 | ... | | 206.15 | 6.65 | ... | ... |
| Kuala Trengganu, Trengganu... | 89.0 | 73.0 | 81.0 | 91 | 69 | 86 | 76 | 83.7 | 84.8 | 11.06 | 280.9 | 2.62 | 14 | 11 | 10 | 14 | 2 | | 228.85 | 7.63 | ... | ... |

* Precipitation ·01 inch or more when measurement is in inches ·2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

# Malayan Agricultural Journal.

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# Committees of the Department.

### The Advisory Committee.

The Director of Agriculture (Chairman).
The Director, Rubber Research Institute.
The Director of Co-operation.
Mr. O. T. Dussek, representing the Education Department.
Yang Teramat Mulia Raja Abdul Aziz, C.M.G., Raja Muda of Perak
The Hon'ble Mr. Egmont Hake, M.F.C.
Mr. Lai Tet Loke.
Mr. J. Melville.
Mr. M. J. Kennaway.
Mr. W. A. Stanton.
Mr. G. S. Reis, B.SC. (Agric.)
Mr. W. N. C. Belgrave, (Secretary).

### Agricultural Pests Supervising Committee.

(Under Sec. 4 of Agricultural Pests Enactment 1913).
The Director of Agriculture (Chairman)
The Hon'ble the Legal Adviser.
Mr. F. H. Mustard.
B. J. Eaton, O.B.E.

### The Departmental Technical Committee.

The Director of Agriculture (Chairman)
The Heads of Divisions.
Mr. F. S. Ward (Secretary).

### The Malayan Agricultural Journal.

Editor: The Agricultural Economist.
Editorial Committee for Department Publications—
The Director of Agriculture (Chairman).
The Assistant to the Director.
The Chief Field Officer.
The Director, Rubber Research Institute of Malaya.
The Editor, Malayan Agricultural Journal (Secretary).

### Coconut & Oil Palm Research Committee.

The Director of Agriculture (Chairman).
The Mycologist.
The Agriculturist.
The Economic Botanist.
The Plant Physiologist.
The Agricultural Economist.
The Agricultural Chemist.
The Entomologist.
The Chief Agricultural Field Officer.
The Assistant Chemist for Copra Investigations (Secretary).

THE

# Malayan Agricultural Journal

OCTOBER, 1930.

## EDITORIAL.

**Rubber Statistics.** Since the review of statistics relating to rubber in the Federated Malay States by Mr. J. Gordon-Carrie was published in the January issue of this Journal, a considerable amount of further work has been done by the Statistical Division of the Department of Agriculture, Straits Settlements and Federated Malay States in collaboration with the Department of Statistics, Straits Settlements and Federated Malay States and the Governments of the Unfederated Malay States; this is being embodied in a new booklet of Rubber Statistics for Malaya which will be issued in the near future. It is proposed to publish most of the tables in an early issue of this Journal, as now that it has been decided that no Government support can be given to any restriction scheme, up-to-date figures of areas planted and of proven yields cannot but be of value and interest to the industry. Two of the tables which will be included in the new booklet are published in this number of the *Malayan Agricultural Journal.* It will be seen that they give details of the areas tapped and the yields obtained during the year 1929 on all estates of 100 acres or over in area in the Federated Malay States and the Straits Settlements.

The Tables show that the average yield of rubber per acre in 1929 were slightly over 485 lbs. in the Federated Malay States and over 417 lbs. in the Straits Settlements. These yields are in both cases considerably higher than those obtained in 1928.

The average area rested during 1929 was less than that rested in 1928 and the number of days upon which tapping took place was considerably in excess of that recorded in 1928.

It is interesting to compare the yields in the Federated Malay States and the Dindings with those for the remainder of the Colony. The recorded yields for the past three years all show much the same comparative results. It is more than probable that this lower productivity of the rubber estates in the older parts of the Colony is due to the fact that many such estates were opened up on land previously planted with sugar cane or tapioca.

During the year 1929, the planted area in the Federated Malay States was increased by 24,125 acres and that in the Colony by almost 2,000 acres. These figures, however, are very small as compared with the area of new planting in the State of Johore; which is for 1929 estimated to be over 125,000 acres.

The yield per acre of the Federated Malay States small holdings still continues at the high level indicated in the charts which were published in the January issue of this Journal. In fact, the monthly figures, so far published in the *Malayan Agricultural Journal,* for 1930 are even higher than those for the corresponding months of the previous year. When it is remembered that the average area of an F.M.S. small holding is not more than two and a half acres and that a large proportion of small-holders have no other source of income than that gained by the sale of their rubber, it is easy to understand that, almost without exception, the small-holders have been compelled by the low price of rubber to press for the production of every possible pound of rubber from their holdings. While some falling off in the yields of the small holdings may with certitude be expected at a not distant date it would be a mistake to expect this falling off in yield to make much difference to the production of Malaya for some time yet to come. It seems highly probable that sheer economic necessity may compel the small-holders to continue to produce their rubber even if the price should fall considerably below the present low levels.

The latest information from the Netherlands East Indies indicates that many of the owners of the so-called "Native (Rubber) Gardens" have ceased to tap their rubber trees; but, in contrast to the small-holders of Malaya, most of the Sumatran owners of small rubber holdings are also producers of padi, fruit, vegetables and other crops. If the present slump results in a substantial increase in the foodstuff production in Malaya, the basic economic position of Malaya's small-holders will be very appreciably improved.

The monthly returns of statistics relating to rubber and to padi now regularly published in this Journal should enable all those interested to keep themselves informed as to the latest available information relating to the production and stocks of rubber as well as to watch the official figures of areas planted with padi.

**Cover Crops and Soil Moisture.** Since the general adoption of the system of cover crops in connection with permanent crops has become an accepted estate practice, the question of the effect of such covers on soil moisture has been a much debated question. The contribution in this number of an article by Mr. W. N. C. Belgrave is, we believe, the first account in this country of scientific investigations from which a definite conclusion can be made. The conclusion drawn by the Author that "no fear need be entertained of harmful effects of covers on the score of reduction of soil moisture content, even on young crops" should finally dispel the fears of those who were doubtful on this point.

**Coffee.** In view of the deflated prices for coffee, the present may appear to many as inopportune for recommending the further extension of the area under this crop in Malaya. During the past few years, this Department has frequently pointed out that the imports of large quantities of coffee for consumption in Malaya would justify an extension of

the area under this crop, and in spite of the present set-back of the coffee market in common with most other agricultural products, it would appear that the price of coffee has reasonable prospects of a satisfactory recovery.

The import and export figures of coffee into Malaya in 1929 are typical of those for some years past. In 1929, the total imports of raw coffee into Malaya were 5,984 tons while exports for the same period were 2,433 tons. Local consumption therefore accounted for 3,551 tons. According to the same source of information, the declared value of this coffee consumed locally was $2,383,817. In addition, the consumption of coffee imported in tins amounted to 317 tons, valued at $760,622. It is seen therefore that Malaya imports annually for local consumption about 4,000 tons of coffee valued at over $3,000,000. This weight of coffee represents the crop of about 15,000 acres.

The present area under coffee in Malaya is estimated at 13,000 acres, the produce of which finds its way mainly to the Singapore market and is either consumed locally or is included in the export figures referred to above. The conclusion therefore is that there is scope for 28,000 acres of coffee in Malaya to satisfy local consumption of which 13,000 acres already exists. If this extra area was in full bearing, there would be a saving to the country of $3,000,000.

In view of these facts and the increasing interest evinced locally in the cultivation of coffee, the inclusion in this number of an article, by Messrs. Bunting and Milsum, on the cultivation of coffee will be helpful to those who wish further to investigate the local possibilities of this crop.

**The Oil Palm Industry.** The plantation oil palm industry in Malaya registers a further development in the opening of a new factory in Johore. The point of interest in this event is that the machinery is the first in Malaya erected for the expression of the oil from the fruit by means of hydraulic presses. Hitherto, the Sumatran factories alone had confined themselves entirely to this method of extraction, while the Malayan factories, without exception, were equipped with machinery for the extraction of oil by the centrifuge method. We are not concerned at this moment with a discussion of the relative merits of the two systems—this question has been adequately ventilated in this Journal and in the Dutch publications—but wish to place before our readers in this number data concerning this new development of the industry in Malaya.

# CULTIVATION OF COFFEE IN MALAYA

BY

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and

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## Introductory.

Coffee cultivation occupies a position of minor importance in the agriculture of Malaya. The official returns of the coffee trade of Malaya for the period 1925—1929, show that the excess of imports over exports averages approximately 58,500 piculs (3,500 tons) of coffee beans valued at $2,390,000 (Straits currency) per annum. Against this the returns of planted areas under cultivation in Malaya show a total of some 13,000 acres under coffee at the present time. It is probable that most of this coffee is interplanted with some permanent crop.

Forty years ago, however, Liberian coffee was the principal plantation crop in Malaya. These areas were cut out and the land planted with rubber about 1900.

In the Netherlands East Indies, particularly in East Java, coffee cultivation is of considerable importance, the annual production amounting to about 2,000,000 piculs. Suitable soil and a large population place Java in a more favourable position as compared with this country for the production of coffee. Almost half the coffee produced in the Netherlands East Indies is grown by Javanese.

There does not appear to be any likelihood of much expansion of coffee planting on the plains in Malaya. Arabian coffee is, however, being grown experimentally by the Department of Agriculture at Cameron's Highlands, Pahang, but it remains to be seen whether circumstances justify the planting of this crop on a large scale on the hills in this country.

## History.

Arabian coffee is recorded as having been grown in Malacca in the eighteenth century. This coffee, however, never proved a success on the plains in Malaya although many attempts in the past were made to cultivate it on an estate scale

The cultivation of coffee in this country owes its inception to the introduction of Liberian coffee in 1875. It appears to have spread rapidly throughout the Peninsula. The introduction of Liberian coffee is referred to by Ridley

(*Agricultural Bulletin, S S. & F.M.S.*, Vol. IV, page 301, "History of Economic Plants"), as having originated what may be termed "planting" on an estate scale in Selangor, Perak and Negri Sembilan. The planting of coffee was particularly timely as it enabled rapid interplanting with Hevea and thus assisted the early expansion of the rubber industry in Malaya.

In 1894, the exports of coffee from Selangor and Perak were about 4,000 piculs, (1 picul = 133⅓ lbs.) increasing to some 16,000 piculs in 1897, when Negri Sembilan produced about 1,000 piculs. By 1901, the export of coffee from Selangor, Negri Sembilan and Perak had risen to 51,239 piculs. The peak year appears to have been 1905 when 107,218 piculs were exported, mostly from Selangor. By this time, however, the coffee estates were largely interplanted with rubber and production of the former crop began to fall rapidly. Interest in Liberian coffee was mostly confined to the period between the years 1875—1898, after which, owing to the fall in the market price of coffee, due to increased output from Brazil, and appreciation of the possibilities of rubber, coffee planting almost entirely ceased and in course of time rubber claimed the majority of coffee estates. A bad attack of the caterpillar of the bee-hawk moth (*Cephonodes hylas*), which occurred in 1900, resulted in considerable damage to many coffee estates in Selangor.

During 1900, *Coffea robusta* was introduced and might have been extensively cultivated but for the planting of Hevea.

In 1910, the total area under coffee was 6,475 acres, almost entirely in the Federated Malay States and practically the whole of this coffee was grown as an intercrop with rubber and coconuts. The planted area in the Federated Malay States gradually decreased to about half, but with the inclusion of Johore, the total area under coffee in Malaya is now shown as 12,907 acres, which is made up as follows—Federated Malay States 9,059 acres, Straits Settlements 848 acres, Johore 3,000 acres.

## Varieties.

For the purpose of this paper, attention is directed to the three main types of coffee, namely; Arabian, known in the Netherlands East Indies as "Java coffee", Liberian and robusta. In addition, brief reference is made to several promising species which have been established at the Government Plantation, Serdang. Among other cultivated coffees may be mentioned the following hybrid forms, which have met with some success in Java:—

Maragogipe coffee—a mutation of arabica, production often small but yields a large bean of excellent colour and flavour.

Kalimas hybrid—liberica x arabica, stated to be practically immune to leaf disease.

Kawisari hybrid—liberica x arabica, a robust hybrid with arabica-like beans.

## Liberian Types.

*Coffea liberica.*—A sturdy tree attaining a height of 30 feet, indigenous to Liberia, West Africa; introduced into the East Indies in 1875. The leaves are large, leathery, deeply wrinkled, pointed at the apex, glossy and oval.

The flowers, of which several are produced in each cluster, are large and pure white in colour. The fruits are large and very variable in size. The colour of the ripe berry varies from yellowish to dark red. The skin and pulp layer are thick. The proportion of fresh fruit to prepared beans is usually about 10 to 1.

*Coffea excelsa.*—A large tree discovered in the Congo in 1904. The branches are coarser and thicker and the leaves larger than *C. liberica.* The berries are smaller than the last named species and darker in colour. The skin is soft and tender. Flowers white, with green stamens, produced in axillary cymes, 1—5 flowers in each cyme. A good type of coffee that will thrive from sea-level up to 4,000 feet. The proportion of fresh berries to dry beans is about 7.5 to 1.

## Robusta Types.

*Coffea robusta.*—A small tree about 10 feet high, collected in the Congo region of Africa in 1900. The tree is umbrella-shaped with long branches bending towards the earth Leaves large wrinkled, thinner than *C. liberica.* Flowers white, produced in dense axillary clusters. Fruit green when unripe, becoming deep red with a purple tinge when ripe. About half the size of *C. liberica,* outer skin thin. *C. robusta* is hardy and flowers early, and for this reason it is commonly used as a catch crop with permanent cultivation. The percentage of fresh berries to prepared beans varies from 3.5 to 1 and 5.5 to 1 according to type and soil conditions.

*Coffea canephora.*—A small tree of the robusta type, collected in Gabon, Africa, and described in 1897. It is a very variable species. The young berries are bronze-coloured, turning vermilion when ripe. The leaves are distinct, being narrow and tapering to a fine point, leathery and flat. This coffee is a heavy yielder and produces berries of good quality; the proportion of fresh berries to dry beans is about 4.5 to 1. In Java it has, unfortunately, been found very subject to leaf disease.

*Coffea Quillou.*—A robusta-like species introduced from the French Congo in 1901. The plant is less variable than many other species and is characterised by the rust-brown colour of the young leaves. When mature the leaves of Quillou are lighter green than those of robusta. The ripe berry is bright red, the proportion of fresh berry to dry beans is about 4 to 1. The trees come into bearing a year later than *C. robusta,* but produce large crops under suitable conditions. Unfortunately it appears more susceptible to the coffee-berry borer than other varieties.

*Coffea Uganda.*—This coffee was introduced from East Africa, as its specific name indicates. The leaves are smaller than those of robusta, being markedly undulating at the edges and curving upwards. The berry is light to bright red. The flowers are smaller than those of the robusta-like species. The proportion of fresh fruit to ripe beans is 4 to 1.

## Arabian Type.

*Coffea arabica.*—A shrub reaching a height of 20 feet when fully grown; indigenous to Abyssinia, Sudan, Guinea, and Mozambique. It is stated to

have been introduced into Arabia during the fourteenth century and subsequently became distributed throughout the warm countries of the world. Arabian coffee has been cultivated in the East for over two centuries. The bark is thin and grey in colour. Leaves elliptical or oval with pointed tip. Flowers pure white, very fragrant, numerous in the axils of the leaves. Berry dark red to yellowish-red. Flesh of fruit very sweet. Arabian coffee was at one time much grown in Ceylon and Java, but in 1869 the coffee leaf disease (*Hemileia vastatrix*) appeared in the plantations resulting in its cultivation being almost abandoned within a few years. This coffee thrives best at high elevations in the eastern tropics. The proportion of fresh fruit to prepared beans is approximately 5.5 to 1.

## Soils and Situation.

Coffee requires a fairly fertile soil, which is loose and porous, and does not contain hard impermeable layers to impede the growth of the tap-root. The bushes are not deep-rooting and about three feet depth of soil is sufficient for their requirements. The root development of coffees, especially robusta, is comparatively rapid and intense and the most suitable soils are those which permit of ready root ramification.

Liberian coffee is most suited to the peaty soils of the coastal district and where efficient drainage is undertaken, to counteract the natural acidity of the soil, excellent growth is made and good crops of berries are obtained. It may be grown most successfully from sea-level to 1,000 feet.

Robusta is stated to be sensitive to soil acidity and does not thrive on the coastal soils. The best results are obtained on inland virgin land, particularly that of granitic origin. This variety can be grown from sea-level up to 2,500 feet.

Arabian coffee is more suited for cultivation on the hills, where it produces beans of excellent flavour. There is little actual experience of the requirements of this species in Malaya, but several small areas at the Experimental Plantation, Cameron's Highlands (4,750 feet elevation) are thriving well. Owing to the susceptibility of this coffee to leaf disease, its cultivation in the East has steadily declined. It thrives best at elevations of 2,000 to 4,000 feet and is totally unsuited for cultivation at sea-level.

## Cultivation.

*Propagation.*—Coffee is ordinarily propagated from seed, though recent work in Java has proved that improvements can be obtained by planting fields with stocks upon which superior clones have been grafted. This mainly applies in the case of robusta and hybrid coffees, which are naturally variable when grown from seed.

Seed for planting should be taken from strong healthy bushes which are known to give good crops The seed should be carefully selected from perfectly ripe berries and, after depulping, mixed with dry ashes and spread out to dry

in a warm shady place. After drying, the seed should be sown as soon as possible in raised nursery beds.

The nursery should be in a sheltered situation, having good drainage, preferably on virgin soil free from all roots, and with ready access to water. The nursery beds, which are usually made about 4 feet wide and 1½ to 2 feet apart, should be well shaded with "ataps." An economical method for raising a large number of seedlings is to prepare nursery beds under the shade of light jungle or "blukar." This method has been employed at the Government Plantation, Serdang, with conspicuous success. The seeds are sown about half an inch deep at distances of about 6 to 9 inches apart, according to the length of time the plants are to remain in the nursery. The number of seeds per pound varies according to the variety. In the case of robusta about 1,600 seeds go to a pound, which should be sufficient to plant up an area of 3 acres, after allowing for failures in germination, with 435 plants to the acre. After sowing, watering and weeding must be attended to and, should the surface soil become caked, a light forking should be undertaken to maintain it in a friable condition. Under normal conditions, the seed will commence to germinate within 6 to 8 weeks from sowing and germination may continue for a further period of at least 6 weeks. The shade should be removed gradually so that the seedlings are fully exposed when they have four pairs of leaves, at which stage they are ready for transplanting in the field. The seedlings may, however, (if necessary) be allowed to remain in the nursery for 6 to 9 months.

*Planting.*—The land having been cleared and drained, should be holed a month or so previous to planting. The holes should be 2 feet deep and at least 1½ feet square. The seedlings should be transplanted at the commencement of the rains, thus enabling them to become established before the dry weather sets in. As is generally known, it is essential to avoid a bent tap-root when planting coffee. Should the tap-root protrude from the transplanter the exposed portion must in every case be removed with a sharp knife.

The planting distances recommended for the several types of coffee are as follows:—

| | | | | | |
|---|---|---|---|---|---|
| Liberian | 12 ft. x 12 ft. | = | 302 | bushes | per acre. |
| Robusta | 10 ft. x 10 ft. | = | 435 | ,, | ,, |
| Arabian | 6 ft. x 6 ft. | = | 1,210 | ,, | ,, |

After planting, the land should preferably be kept clean weeded, since coffee cannot withstand a heavy cover plant or weeds round its roots. Experience at the Government Plantation, Serdang, has proved conclusively that low-growing cover plants seriously retard the growth of coffee. Provision should always be allowed for supplying vacancies and when undertaking this operation all sickly or stunted plants should be removed and replaced by healthy seedings.

*Shade.*—As already stated, coffee is a shallow-rooted plant, with lateral roots spreading out near the surface of the soil. Shade is therefore beneficial not only to protect the roots from drying out but to provide the surface soil with a mulch of fallen leaves. In the early stages of growth, *Tephrosia candida,* or other similar tall-growing leguminous plants, may be grown between the

rows of coffee. Leguminous trees, such as *Gliricidia maculata* and *Erythrina* spp., should be planted at distances of about 20 ft. by 20 ft. apart in order to provide high shade.

*Pruning.*—The primary object of pruning is to improve the form of the bush so as to encourage the maximum production of berries by allowing free access of light and air round the main stem.

When the plants are about one year old, all suckers and superfluous stems should be periodically removed to prevent the formation of excessive branches. Double stems should be cut with a sharp pruning knife, but the suckers at the base of the main stem are best broken off by hand while they are comparatively small.

After the majority of bushes have attained a height of about 7 or 8 feet, the main stem should be pruned back with a sharp knife to within a height of about 5 or 6 feet and the cut should be made in a sloping direction about one or two inches above a primary or lateral branch emerging from the leading stem. It is important that only those stems with brown or mature wood should be topped. This treatment, which is known as "topping," causes the secondary and tertiary branches to develop strongly so that thinning out of the latter must follow in due course.

The branches which arise straight from the main stem are known as "primary" or lateral branches. These again develop side shoots, in pairs, which are termed secondary branches. Normal pruning is not usually undertaken until the third or fourth year. In carrying out this operation all secondary branches within about 6 or 8 inches of the main stem should be cut away and afterwards alternate secondaries on each side of the primary or lateral branch should be thinned out.

Further, the pruning of lateral cross branches, particularly those growing towards the main stem or those growing upright and parallel with the stem, should be periodically carried out at intervals of about 6 months.

It is obvious that each species or variety of coffee requires different treatment and with robusta or Quillou types of coffee the removal of secondaries is not so necessary as in the case of the Liberian types. In fact, in the case of the robusta or Quillou types of coffee, very few secondary branches are formed and attention need only be given to the periodical pruning of suckers on the main trunk and the removal of one or two leaves which develop on the upper sides of the lateral branches and which have a tendency to cover up the ripening berries.

The removal of suckers from the main stem should be carried out regularly every 6 to 8 weeks, otherwise their growth will very soon exhaust the bushes and the yield of fruit will become adversely affected.

## Coffee as a Catch Crop.

In considering coffee as a catch crop with permanent cultivations such as rubber, coconuts, and oil palms, it has to be borne in mind that little or no crop

in a warm shady place. After drying, the seed should be sown as soon as possible in raised nursery beds.

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## Coffee as a Catch Crop.

In considering coffee as a catch crop with permanent cultivations such as rubber, coconuts, and oil palms, it has to be borne in mind that little or no crop

may be expected from the coffee after the fifth year. In the case of oil palms the growth of the palms is so rapid that the coffee is crowded out during the fourth year. This difficulty may be partly overcome by planting the coffee at least one year ahead of the main crop.

Robusta is the most suitable type of coffee for this purpose as it produces comparatively good crops during the third and fourth year after planting. Liberian coffee is often grown as an intercrop with coconuts in the coastal districts and under such conditions is frequently profitable. Robusta coffee is more suitable for inland soils and provided the principal crop permits of a fair lease of life to the coffee, and the soil is sufficiently fertile, it may be grown on a profitable basis. Arabian coffee appears to be more suited as a sole crop on the hills.

## Manuring.

Coffee is not a very exhausting crop and if planted on rich virgin soil it should not require manuring until it has been in bearing for a number of years. In fact, it exhausts the soil so slowly that even on comparatively poor land it may remain productive for 4 or 5 years without the application of manure.

The judicious use of green manures, such as *Tephrosia candida* or *Crotalaria anagyroides*, provided the prunings are periodically incorporated with the soil, will assist materially in maintaining soil fertility.

Experience in other countries has shewn that undoubtedly the best manure for coffee is cattle manure and as the supply of this is usually inadequate it may be necessary to resort to the use of artificial fertilisers. When cattle manure is not available it may be substituted by a compost consisting of coffee husks, dried pulp, well-rotted grass, weeds and other crop residues with a mixture of wood-ashes, which should be allowed to decompose thoroughly before being applied to the soil.

Although little definite information is available regarding the most suitable mixtures of artificial fertilisers for coffee it is recommended that a trial be made with a complete mixture, as usually adopted in Southern India, consisting of 100 lbs. sulphate of ammonia, 200 lbs. of superphosphate and 100 lbs. of sulphate of potash as a standard dressing at the rate of 400 lbs. per acre every alternate year.

Artificial manures should always be applied at the beginning of a dry season and it is advisable to broadcast the mixture between the rows of coffee and fork it lightly into the soil. The artificial manure should always be placed near the extremities of the feeding roots and not round the bole of the bush.

An application of about 8 to 10 piculs of freshly burnt lime per acre, a few months before applying the mixture of artificials, will often given beneficial results on the more acid types of soils. The lime should be first of all air-slaked under an open shed, then broadcasted as a fine powder and lightly forked below the surface of the soil.

## Diseases and Pests.

The diseases and pests that attack the coffee bush are serious and have resulted in great loss to coffee planters in the past.

The most serious disease is the coffee rust or leaf disease (*Hemileia vastatrix*). In the nursery or early days in the field this disease may be kept in check by hand-picking or spraying with copper sulphate solution. Experience in Java shows that little can be done to control this disease once it becomes established in a coffee estate. Further experience in that country indicates that the Liberian and robusta varieties are becoming more susceptible to the disease. Pink disease (*Corticium salmonicolor*) attacks the woody parts of the bushes and sometimes causes serious damage. There are also various root rots, not yet well known, the commonest being brown-root disease.

About thirty years ago, when Liberian coffee was extensively planted in Selangor, considerable damage was done to the bushes by caterpillars of the bee-hawk moth (*Cephonodes hylas*). This pest may be controlled by hand-picking the caterpillars or spraying with lead arsenate. Steps should be taken to eradicate the caterpillars as soon as noticed, otherwise there is a possibility of this pest getting out of control.

Recently the coffee berry-borer (*Cryphalus hampei*), a small beetle which bores a hole into the green or ripe berry, has made its appearance in this country. This is considered to be a serious pest in Java and difficult to control, since its spread is facilitated by the transport of bags and other material, from one estate to another. The Quillou variety appears to be more susceptible to this pest than any other variety. *Lecanium viride*, a small greenish-coloured scale insect, is often troublesome. It may, however, be controlled by spraying with kerosine emulsion.

## Harvesting.

In the Liberian types, the fruit is borne throughout the year, during which time two fairly heavy crops may be expected, one about May/June and the other about December/January. The collection of fruit, however, goes on all the year round. Only ripe berries should be harvested as the pulper cannot deal with unripe fruit.

The robusta types blossom throughout the year and the berries should therefore be collected once a month. The fruits mature within about ten months from flowering and are ready for picking when the greater number in the cluster are straw-coloured; the whole cluster may be generally gathered at once.

The Arabian or "Java" coffee also flowers spasmodically throughout the year; harvesting, therefore, is more or less continuous.

In picking coffee, it is most important that the berries should be perfectly ripe and care should be taken that no immature or over-ripe berries are mixed with the main crop. The bushes are inspected several times and the ripe berries collected at each round until the crop is harvested. Additional labour will be required during the heavy cropping seasons and at such times

the harvesting is usually carried out on contract. After the last picking round is completed, it is the practice in some countries to strip off all the remaining berries, whether ripe or not, and collect all fallen berries. This fruit is of inferior quality and is therefore kept separate from the main crop, being sold as second grade coffee.

## Yields.

Yields are dependent upon both the variety and the soil conditions. With Liberian types, the bushes commence to produce fruit about three years from the date of planting and are considered to be in full bearing after the fifth or sixth year. The average yield of Liberian coffee in full bearing is about 3½ to 4 piculs of beans per acre. The life of this coffee is from 25 to 30 years.

Robusta coffee commences to flower early, often when the bushes are only nine months old. A small crop of fruit may be collected in the second year while the maximum will be obtained in the fourth year. Yields during the third year are 2 to 3 piculs of beans per acre and from the fourth year onwards a return of 4 to 6 piculs of beans per acre may be expected. Robusta coffee will continue to yield satisfactorily for a period of 10 to 12 years.

Definite information regarding yields of Arabian coffee in this country are not available. Yields in Java, however, are stated to be somewhat less than those obtained from robusta coffee.

## Preparation.

When the berries are brought to the factory by the pickers they are either measured or weighed and then placed in a receiving tank.

In this country, the wet-method of preparation is the one most commonly practised and as it requires large supplies of water it is essential that the factory should be situated near a plentiful supply of fresh water.

In order to obtain the best results by this method it is most important to see that the berries are quite ripe and treated the day they are picked. If pulping is delayed for any length of time the berries will begin to ferment, which causes the beans to became discoloured.

The principal operations in the preparation of coffee, which consist of pulping, fermenting, washing, drying and hulling, may be briefly described as follows:—

*Pulping*.—The removal of the pulp surrounding the beans is effected by means of de-pulping machines. The concrete receiving tanks, which are constructed with a sloping base, should be placed at a higher level than the pulper and fitted with a 2½ inch pipe for supplying a constant supply of water. The berries are delivered direct from these tanks in a stream of water to the hopper of the pulper, where the outer skin is disintegrated by means of vertical iron discs, covered with copper, having a surface of numerous blunt projections. These discs revolve against the adjustable steel pulping bars, the pulp and beans being delivered at separate outlets. A certain amount of partially pulped

or unpulped berries generally pass through with the beans and these may be separated by a rotary screen, the unpulped material not passing through the mesh in the screen being returned to the pulper and re-pulped. A quantity of pulp is sometimes carried through with the beans in which case the mass is placed in a shallow tank containing water, where it is stirred vigorously. The light pulp then floats to the surface and is removed by withdrawing the water from the top of the tank, the heavy parchment remaining at the bottom. It is most important that the steel cutting bars on the pulper should be properly adjusted, otherwise the beans will become cut or bruised and spoil the sample.

*Fermenting.*—When the depulped berry, known as parchment, comes from the pulper it is covered with a slimy substance and this is removed by fermentation. During this process the parchment is washed into concrete tanks where, after removing the water, it is covered with gunny sacks and allowed to ferment for a period of 30 to 36 hours. The fermentation tanks are usually about 3 feet deep and constructed with a sloping floor so that the water can be run off through a perforated steel plate, which retains the parchment.

During fermentation a certain amount of heat is generated and this decomposes the sugary coating on the bean so that when the process is complete the slimy covering can be easily removed by washing. When the operation is complete the parchment has lost its slimy feeling and is somewhat rough on being grated in the hand. The process of fermentation depends on the temperature of the air, consequently the time taken for coffee to ferment properly will vary somewhat at different periods of the year. It is therefore necessary to make periodical tests in order to ascertain when the fermentation is complete, otherwise it may be carried on too far with the result that the quality of the coffee will be impaired.

*Washing.*—When fermentation is complete, the parchment should be trampled into a sticky mass in the tanks and then covered with water. The water is afterwards run off and the parchment then turned into concrete washing channels containing a plentiful supply of running water, where it is stirred with wooden paddles against the flow of water until it is perfectly clean, when it feels quite rough. Any floating or other imperfect beans are skimmed off and classified as inferior grade coffee.

*Drying.*—After washing, the parchment is allowed to drain for a while and is then evenly spread about one inch deep on a cement barbecue to dry in the sun. The beans should be periodically turned and not allowed to become wet, either by rain or dew, during the operation of drying, which may take from 8 to 10 days to complete.

On large plantations artificial drying might be practised with advantage, since by this method the parchment can be thoroughly and evenly dried within a period of about 48 hours by the use of hot-air driers.

When the parchment is entirely dry it is quite brittle and the bean is so hard that it cannot be dented by the teeth. It is most important that coffee should not be stored in bulk until it is thoroughly dry, otherwise it will ferment and the beans become musty.

*Hulling.*—The next operation is the removal of the parchment, which is usually carried out by hand. The broken outer shells and the silver-skin are then separated from the beans by sieving and winnowing, after which the coffee is graded according to size and colour.

## Marketing.

When the coffee is quite dry it should be bagged and marketed as quickly as possible, since if it is stored for any length of time after hulling the beans commence to deteriorate in quality.

At the present time, coffee is only grown in Malaya for local consumption and the demand in the local markets is for a large bean of the Liberian type, which would find little sale on the London market, where the demand is for the smaller-seeded types such as robusta and arabica.

Liberian types of coffee are unpopular on the London market on account of their peculiar flavour.

Although considerably higher yields are obtained on the plains than on the hills the coffee is inferior in quality and, consequently, realises a lower price on the Home markets, where the present demand is for the finest grade only. Coffee grown at high altitudes has a distinctive flavour and is therefore largely used for blending with inferior qualities.

As already stated, since the world's visible supplies of coffee are greatly in excess of consumption and are considered likely to continue so for some time to come, the production of other than first grade coffee for the London market cannot possibly be recommended. Local consumption is, however, fairly considerable and there appears no reason why this demand should not be met by Malayan produce.

# THE EFFECT OF COVER CROPS ON SOIL MOISTURE

BY

W. N. C. BELGRAVE,
*Plant Physiologist.*

Cover crops have become a standard part of agricultural practice in Malaya of late years as valued aids in the fight against soil erosion, which is necessarily active because of our frequent and heavy rains.

The efficacy of covers as soil retainers is indisputable, but there is little information as to their effect in other directions on the soil and the crop. Points on which information is badly needed are:—effect of covers on the microbiological flora of the soil, the soil atmosphere, humus, quantity of readily available nutrients and moisture. One school of thought stressing, perhaps unduly, high soil temperatures in bare soil, assumes that covers must always be beneficial; the other stressing, again perhaps unduly, the competition which must be set up between cover and main crop for the relatively small quantity of soluble nutrients existing at any given moment in our soils, considers that covers may be harmful and should be employed with care—especially in the case of young main crops. Neither school of thought has as yet definite evidence to support their views. In order to test these and other points which may arise, the Agriculturist S.S. & F.M.S. has laid down a series of plots at the Government Experimental Plantation Serdang where different covers can be grown for a term of years and their effects on the soil and crop studied by various Divisions of the Department. There are two plots, one on flat land on a moderately light soil, the other on a steep, bare and somewhat heavily washed hillside. Unfortunately the covers on the latter plot have grown very badly, and no useful observations can yet be made. On the flat block there is one control plot which is left clean weeded, on the hill two controls, one clean weeded and the other silt pitted. Each plot of cover or control is ¼ acre in extent in the form of a narrow rectangular strip.

The covers were planted in November, 1929. Best growth was made by *Centrosema pubescens, Calapogonium* and *Mikania scandens*. Observations on moisture were started on 1st May, 1930.

A few preliminary observations on a somewhat similar soil type made a few years ago had indicated that no great differences between cover and clean weeded plots were to be anticipated; it was therefore clear that a number of samples would have to be taken on any one day, in order to reduce experimental error as far as possible.

The quantity of moisture in the soil at any given level at any given time is the result of a balance between different factors—of which on the positive side we have (a) rainfall, (b) retention of rain, (c) capillary rise of water from lower to higher soil levels and on the negative, (d) surface loss as vapour, (e)

percolation downwards below root level, (f) run-off. Of these (a) and (c) are unaffected by covers while (d) is the factor likely to be most affected; on the one hand we have a lower soil temperature but transpiration from the leaves of covers; on the other, possibly intense evaporation from hot bare soils. Other subsidiary changes may be tabulated as follows:—

| *Land under cover.* | *Bare land.* |
|---|---|
| Interception of part of the rainfall by cover and subsequent evaporation therefrom, the water not reaching the soil at all. | All rain reaches the soil surface. |
| Considerable reduction of the run-off from heavy showers, more time for water to penetrate soil. | High percentage of run-off—especially when soil surface becomes "packed." |
| After some time, especially if crop is turned in at intervals, organic content of soil may be raised with consequent increase of water-holding capacity. This however requires further investigation. | |

All these subsidiary factors, with the exception of the last, should operate in favour of the cover as the slope of the land and the heaviness of the soil increases—results showing no difference or a difference favourable to covers obtained on the block under investigation, which is flat and on comparatively light soil, should therefore be applicable with some certainty to any other situation, although the reverse would not necessarily hold.

Since it is obvious by inspection that the surface (two inches) of the clean weeded plot was always drier than that on the covered plot and since this portion is of little or no importance to the roots of any tropical crop it was neglected and samples taken at successive depths of 2″-6″, 6″-12″, 12″-18″ with a golf-green auger. Six bores were made on each plot.

Each sample was well mixed by hand in a tray and a tin holding about 200 grams of soil was then completely filled and tightly covered. As soon as possible the tins were brought into the laboratory, and a sample of about 30 grams of soil obtained by successive quarterings was dried out for moisture content. As anticipated, considerable—but not excessive—variation was found in the moisture content of comparable samples from the same plot on the same day. Statistical treatment indicated that a moisture difference of less than 5% of moisture on any one day could not be regarded as "significant" i.e. that it might be due to chance. A smaller difference on successive dates of similar weather conditions would be significant provided the difference was always or nearly always in the same direction.

Inspection of the means given below shows that no differences of 5% on any one date were found, nor was there any constancy of direction of difference—in other words, as far as these experiments go, the covers tested have

neither increased nor significantly diminished the water in the soil under weather conditions ranging from moderately wet to very dry.

This result indicates that the various factors affected by the change from bare land to covered land have in this experiment approximately balanced.

For reasons given above, such results obtained on this block may be taken as applying to practically every situation likely to occur in Malaya and it seems legitimate to conclude that no fear need be entertained of harmful effects of covers *on the score of reduction of soil moisture content* even of young crops.

On the other hand, there is no evidence that crops growing on bare flat land of the type dealt with would suffer from drought.

The reservation italicised above is important as many other factors have to be considered which may not necessarily follow the same line. To give one example, nitrate determinations on these soil samples show conclusively that traces only of nitrate exist in the soil carrying covers, while the bare soil contained appreciable quantities (3-4 parts per million nitrogen as nitrates). This and other factors will be dealt with as information becomes available.

The writer desires to express his thanks to Messrs. J. N. Milsum and T. D. Marsh, Assistant Agriculturists, for help in carrying out the observations.

## TABLE A.

*Means of moisture contents. Percentage.*

| Date. | Position. | Centrosema. | Bare. | Mikania. |
|---|---|---|---|---|
| 1.5.30 | Top | 30.1 | 28.2 | 30.9 |
| | Middle | 31.5 | 27.5 | 32.7 |
| | Bottom | 31.7 | 29.8 | 32.1 |
| 15.5.30 | Top | 21.2 | 24.8 | 28.8 |
| | Middle | 23.6 | 26.5 | 29.6 |
| | Bottom | 24.0 | 27.2 | 30.1 |
| 29.5.30 | Top | 17.2 | 19.0 | 19.9 |
| | Middle | 20.9 | 22.8 | 23.1 |
| | Bottom | 23.1 | 24.6 | 24.7 |
| 8.7.30 | Top | 18.5 | 21.0 | 20.9 |
| | Middle | 21.1 | 25.5 | 23.8 |
| | Bottom | 23.2 | 25.7 | 24.7 |
| 8.8.30 | Top | 15.8 | 19.6 | 17.5 |
| | Middle | 20.5 | 22.0 | 22.0 |
| | Bottom | 22.0 | 23.2 | 21.7 |

## TABLE B

*Example of actual moisture contents found (percentages).*

*May 15th, 1930.*

| CROP. | POSITION. | | |
|---|---|---|---|
| | Top. | Middle. | Bottom. |
| Centrosema ... | 14.8 | 19.7 | 18.5 |
| | 24.5 | 28.1 | 28.1 |
| | 24.1 | 25.2 | 25.6 |
| | 22.0 | 21.5 | 26.2 |
| | 22.2 | 23.5 | 20.2 |
| | 19.5 | 23.8 | 25.6 |
| No Crop ... | 25.8 | 29.4 | 31.5 |
| | 28.7 | 30.5 | 30.8 |
| | 19.0 | 21.0 | 22.6 |
| | 22.9 | 27.7 | 27.6 |
| | 26.2 | 25.6 | 29.6 |
| | 26.1 | 24.8 | 27.4 |
| Mikania ... | 30.8 | 35.1 | 32.8 |
| | 32.2 | 30.5 | 30.8 |
| | 28.3 | 27.4 | 31.5 |
| | 29.1 | 30.4 | 30.6 |
| | 27.7 | 27.7 | 29.4 |
| | 24.9 | 26.1 | 25.8 |

## TABLE C.

*Rainfall for weekly periods.*

| Date. | Total Rainfall, inches. | Number of Rainy Days. |
|---|---|---|
| *April, 1930.* | | |
| 1-7 | 3.63 | 6 |
| 8-14 | 3.19 | 3 |
| 15-21 | 1.77 | 3 |
| 22-28 | 5.68 | 3 |
| 29- 5th, May | 2.99 | 5 |
| *May, 1930.* | | |
| 6-12 | 2.28 | 3 |
| 13-19 | — | — |
| 20-26 | — | — |
| 27- 2nd, June | — | — |
| *June, 1930.* | | |
| 3-9 | 2.04 | 4 |
| 10-16 | 1.75 | 4 |
| 17-23 | 1.33 | 3 |
| 24-30 | — | — |
| *July, 1930.* | | |
| 1-7 | .20 | 1 |
| 8-14 | .21 | 2 |
| 15-21 | .30 | 1 |
| 22-28 | — | — |
| 29- 4th, August | — | — |
| *August, 1930.* | | |
| 5-11 | .71 | 3 |
| 12-18 | .37 | 2 |
| 19-25 | 2.17 | 3 |
| 26-31 | 3.32 | 5 |

# THE PALM OIL FACTORY AT ELAEIS ESTATE, JOHORE.

**The following account has been prepared by the Department of Agriculture, S.S. and F.M.S. with the Assistance of Messrs. Guthrie & Co., Ltd., and the Staff of Elaeis Estate, Johore.**

The inauguration of the new palm oil factory of Elaeis Plantations Limited, which was officially opened by His Highness the Tungku Makota of Johore on Sunday the 10th. August, 1930, affords an opportunity for a brief account of this undertaking which, it is considered, may be of interest to readers of the *Malayan Agricultural Journal* inasmuch as it represents the first palm oil plant that has been erected in Malaya in which the oil is expressed from the fruit by means of hydraulic presses. In Malaya, all the palm oil factories which have been erected hitherto have utilised the centrifugal machine for the extraction of the oil from the fruit. There are a number of factories of this type in existence and their lay-out is fairly well-known, but the design and construction of the plant at Elaeis Estate differs in a number of other respects from existing installations.

The plant is housed in a steel-framed building covered with corrugated galvanised iron; in general appearance and type it resembles closely those which have become familiar in sugar-growing countries as the standard type construction for sugar factories. The overall dimensions of the building are as follows:—

| Length. | Breadth | Height. |
|---|---|---|
| 164. ft. | 56 ft. | 52 ft. |

## General Description and Working of Plant.

The bunches of oil palm fruits are harvested and placed direct into perforated wrought iron cages in the field, then transported to the factory on light railway by means of a small steam engine. The cages, which are semi-circular in shape and provided with side doors, have a capacity of about 1¼ tons of fruit bunches each and two of these are carried on each field bogie. The trucks on arrival at the factory pass over a weighbridge and after the weights have been noted, the cages are lifted from the field trucks and placed on special steriliser trollies, which are fitted with ball-bearings to facilitate handling.

*Steriliser.*—These trollies are conveyed on rails into the bunch steriliser, which consists of a cylindrical container having an internal diameter of 1,700 mm. and an overall length of about 8 metres, capable of receiving three cages and the contents bodily so that the fruit bunches may be treated without unloading. The bunch steriliser is closed by means of a circular door capable

of being hermetically sealed. It is heated by means of live steam from the main steam range which is reduced by means of a reducing valve to 40 lbs. pressure per square inch, giving an internal temperature of about 130° Centigrade. Since the steriliser holds three cages, each containing $1\frac{1}{4}$ tons of fruit bunches, the sterilising capacity is $3\frac{3}{4}$ tons per charge. The sterilisation occupies one hour and it takes approximately 20 minutes to charge and discharge the trucks. Therefore, with a working day of 11 hours the steriliser can be charged 8 times, giving a total output of about 30 tons of fruit bunches per day.

*Bunch Elevator.*—When sterilisation is complete, the trollies are removed from the steriliser and transported on a rail system, fitted with turn-tables to facilitate handling, to the bunch elevator. The sterilised bunches are then discharged at the base of the elevator by opening the side of the cage. They are then fed into the elevator buckets and discharged on the stripper platform, which is the highest point in the building. The capacity of the elevator may be increased or reduced by changing the size of the pulley on the driving shaft.

*Stripper or Threshing Machine.*—The sterilised bunches are raked into a semi-circular iron grating between the bars of which rotate cast-steel beaters for stripping the fruit from the bunches. The grate is adjustable and should be fixed at such an angle as to allow of almost continuous working. In the stripper the fruit is threshed from the bunches and falls into worm conveyors, which carry it into the stirring-kettles. The small leaves and stalks, which are separated from the cleaned fruit by means of a strong current of air, are blown into the chute through which the empty bunches fall on being automatically discharged from the far end of the stripper.

*Stirring-kettles.*—These consist of steel cylinders 800 mm. in diameter and 1,285 mm. in height, which are steam-jacketed and fitted with revolving cast steel stirring arms, running at about 25 revolutions per minute, whereby the fruit is broken up. The steam jacket is subjected to a pressure of 118 to 120 lbs. per square inch, i.e. the normal boiler pressure.

*First Presses.*—The pulped mass is discharged into one of the first presses, the feeding of the latter being regulated by hand by means of an adjustable shutter situated at the base of the stirring-kettle. The all-steel first presses have cages with a diameter of 400 mm. and 650 mm. in height. The rams have a diameter of 150 mm. with a maximum stroke of 600 mm. The mashed fruit is packed into these presses in layers about 4 or 5 inches in depth, each successive layer being separated from the next by means of a steel plate, the function of which is to distribute the pressure evenly throughout the load when the press is charged and to facilitate handling of the press cake. The presses are worked very rapidly and are capable of manipulating 10 to 14 charges per hour, but working on the average at about 12 charges, which is equal to about 730 kilogramms of fruit per hour.

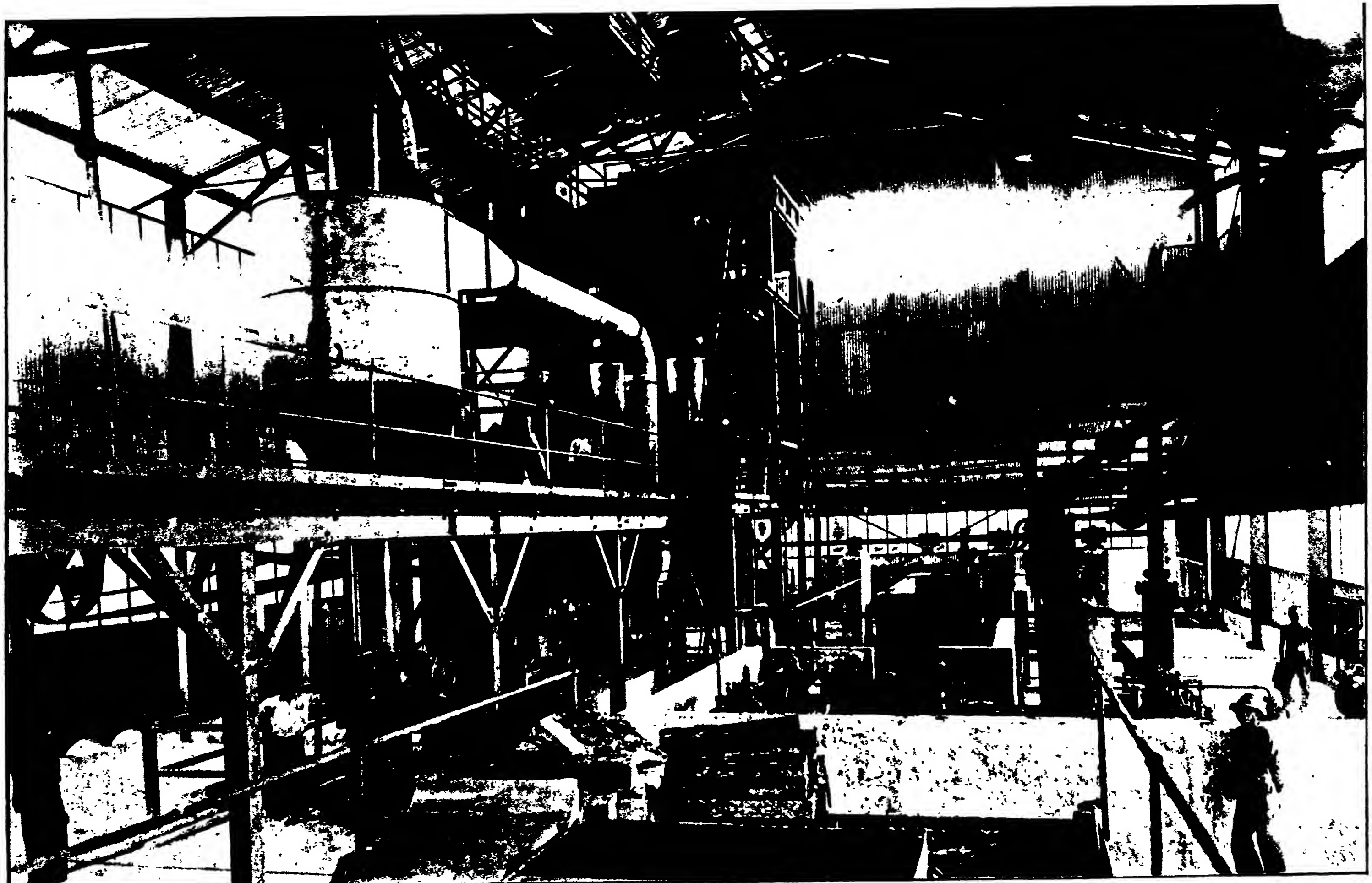
Duplicate first presses are provided, each press being operated by means of self-contained hydraulic pumps of special design without accumulators. The

usual pressure applied to the cake is 15 to 20 kilogramms per square centimetre, which corresponds to a pressure of 110 to 145 kilogramms per square centimetre on the ram. The pressure on the hydraulic pumps can be reduced or increased by adjusting the springs of the pumps and they are capable of developing a pressure of 480 kilogramms per square centimetre. It is stated that either ordinary lubricating oil or an emulsion of oil and water may be used in the hydraulic pumps. The cages of the presses are kept clean by means of a spray-pipe connected with the steam-jacket of the stirring-kettle.

The oil which flows from the presses during the operation of pressing passes to the crude oil containers. When the first pressing is completed, the cakes are pushed out of the press cages by means of the rams and thrown into a hopper situated between the two presses.

*Drier and Depericarper.*—The residue from the first pressing is discharged into a special form of drier consisting of a large closed tank-like chamber with three bands of perforated screens travelling backwards and forwards in the upper part and a horizontal drum rotating in the lower section. In this machine, the cakes fed in at the top from the presses, are first of all broken up by means of a rotating crusher, after which the mixture of nuts and fibre is spread out in thin layers on moving perforated slats or screens. At the end of each traverse an ingenious arrangement opens the slats of the conveyor and allows the materials to fall on to the next layer of slats. Hot air is forced through the drier by means of a fan, thus drying the fibre (and to a certain extent the nuts) as it is carried over the slowly moving slats. The dried material then drops to the rotating drum below, where the loose fibre is forced by a strong air-blast along a shaft leading to the second press. The nuts, which are too heavy to be lifted by the air current, are then rolled and rubbed clean of adhering fibre in the rotating drum. The cleaned nuts leave the depericarper at the end of the drum and fall into a bucket elevator, which takes them up to a worm-conveyor at the top of the building.

*Second Press.*—The fibre, from which most of the moisture has been removed, is pressed a second time under high pressure and all possible oil removed. The residue fibre is then taken to the boiler to serve as fuel. The operation and construction of the second press is similar to that of the first, except that it gives a higher degree of pressure. The all-steel second press has a cage of 400 mm. in diameter and 1,040 mm. in height. The ram has a diameter of 300 mm. while the maximum stroke is 1,010 mm. Like the first presses, it is steam-jacketed and works to a pressure of 480 kilogramms per square centimetre. Allowing for the first presses treating 1,250 kilogramms of fruit per hour this gives approximately 250 kilogramms of dry fibre per hour for treatment in the second press. Since the latter has a capacity of 40 kilogramms per charge and will take six charges per hour, one second press is capable of handling the output of two first presses. It is estimated that after the pulp has passed the second press the residual oil content ranges between 10 and 12 per cent dry fibre.



INTERIOR OF OIL PALM FACTORY, ELAEIS ESTATE, JOHORE.

General View of Elaeis Estate and Oil Palm Factory.

*Oil Collecting Tank.*—The oil from both the first and second presses passes through pipes to an open tank and as required it is fed by gravity from there into a closed cylindrical tank. After closing the slide-valve, a jet of steam is admitted into this cylinder so that the oil is driven by pressure along pipes to either of the two settling tanks.

*Clarification Tanks.*—Each of these settling tanks has a capacity of about 5,000 litres of oil, which is equivalent to the amount of oil extracted during 10 hours, plus condensing water (added during the process of extraction) and sediment. Each tank is thus filled every alternate day, which allows ample time for settlement of the sediment and water. The crude oil in the settling tanks is heated with live steam, and also by steam coils from the base of the tanks, to a temperature of about 90 to 100° Centigrade, which assists in the separation of oil and water. After the contents of the tanks have been allowed to settle for some time, the sediment and water is drawn off into a sediment tank where the mixture is treated again with steam in order to recover as much oil as possible. The purified oil is then fed into a centrifugal separator for final purification after which it passes into the storage tank.

*Storage Tank.*—The storage tank for the final product has a capacity of 6,000 litres of oil. This tank is fitted with steam coils for indirect heating, but care has to be taken to see that the oil is not run off too warm otherwise it may melt the glue in the barrels. An automatic barrel-filler is fitted to this tank to facilitate the packing of the oil.

*Conveyor for Drying Nuts.*—The nuts after leaving the depericarper are taken by an elevator to a large perforated worm-conveyor, which is situated near the roof of the building. Hot flue gases are blown through the nuts as they pass slowly along the conveyor so that by the time they reach the end of the conveyor the nuts are sufficiently dry to allow of them being cracked without delay. This prolonged heating is necessary in order to ensure that the kernels are separated from the shell before cracking. The conveyor holds about 2,000 kilogramms of nuts, which is equivalent to an output of four hours working with 1,250 kilogramms of fruit per hour, and in order to obtain the highest efficiency it should always be filled. The output may be regulated by the removal of cast steel stirring arms attached to the shaft passing through the centre of the conveyor.

*Nut-Crackers.*—The dried nuts passing out of the worm-conveyor fall into a rotating sieve provided with scrapers and having slots of 18 × 50 mm., where they are sorted into large and small nuts. This separation is made to facilitate the separating of the kernels from the shells after the nuts are cracked. The two nut crackers are identical. The small nuts falling through the perforations drop down a chute into one of the centrifugal nut-crackers, while the large nuts leaving the sieve at the end are conveyed into a second nut-cracker. Each of the nut-crackers is provided with its own rotating perforated sieve into which the cracked material is conveyed by means of chutes. For the nut-cracker dealing with the smaller nuts the sieves are provided with 5 × 28 and 11 × 35 mm. slots

whilst the other has $6 \times 30$ and $14 \times 35$ slots. The smaller pieces of shells and dust fall through the smallest slots into a chute, whereas the remaining portion, consisting of large pieces of shells and kernels, fall through the second part of the sieve into the separator below. The uncracked nuts passing out through the end of the drums fall into a container and are returned to the nut-crackers.

*Shell-Kernel Separator.*—The separation of the shells and kernels is effected by allowing the material to fall into a shallow tank containing brine or clay having a specific gravity of 1.16 to 1.17. The shells, having a higher specific gravity than the liquid, sink to the bottom of the tank, while the kernels float on the surface. The kernels floating on the surface have a tendency to drift towards the rotating screen through which part of the clay or brine solution flows off. As the kernels pass along the latter part of the screen they are washed with clean water and are discharged from the separator. The wet kernels are then conveyed to a hot-air drier and packed direct into bags as they pass out of this machine. The broken shells which sink to the bottom of the separator are brought into a rotating screen by means of a wheel to which perforated buckets are attached. The shells are washed with clean water as they travel through this screen and leave the separator when they are taken to the boilers for fuel.

*Power Unit.*—The steam supply for the factory is maintained by means of a boiler of the Cornish type giving steam to the main steam range at 120 lbs. per square inch. The moving parts of the factory are operated by means of a horizontal single-cylinder steam engine of approximately 56 H.P., while a small electric light plant is also provided.

*Output of Factory.*—The estimated output of the factory at present is 825 tons of palm oil per annum, but this will be doubled when the second unit of machinery is added to deal with areas coming into bearing later on. Assuming an average output of approximately 16 cwts. of palm oil per acre per annum the factory will be capable of dealing with the output of a plantation of fully 2,000 acres, or with the installation of a third unit 3,000 acres can be dealt with.

*General.*—The layout of the buildings is excellent, the successive stagings and the large amount of clear space enabling a full view of practically all parts of the operation being maintained from the floor of the factory.

# Abstracts.

## PADI EXPERIMENTS 1929—1930.*

Rice selection work has been carried on by the Department of Agriculture for a some of years past and a number of strains have been evolved which are known to be capable of giving higher yields than those normally cultivated.

Rice growing conditions vary greatly from district to district; and even within the confines of one district variations in soil texture and composition and in water supply—probably the most vital factor—are frequently considerable; consequently it is desirable that trials should be conducted in as many as possible of the larger padi growing areas. This policy is now being put into effect.

All experimental work on rice aims at an improvement in crop yields and this objective is being attacked from three different directions. Firstly, efforts are being made to improve the yields of existing rice fields by the selection of high yielding types of padi, testing them under the varying environment conditions found in different areas and by distributing the successful varieties to the cultivators for cultivation on a large scale. Secondly, investigations into the manurial requirements of padi are in progress, and when experiments shew definitely which manures are the most remunerative, steps will be taken to demonstrate their utility and to encourage their use. Thirdly, experiments towards improving existing methods of cultivating the rice fields are in progress and may reveal improvements which will react favourably on crop returns.

These three methods of increasing local production of rice are in operation in different experiment stations. Selection experiments are confined to Titi Serong (Krian, Perak) and Pulau Gadong (Malacca) experiments stations as it is considered that selections capable of satisfying the varying needs of the country can be made at these two stations. Stations for testing the relative merits of selected types have been established in various parts of the country, and some of these have also given useful results as demonstration stations and as centres of seed distribution. Manurial investigations have been conducted at four stations in the past. They have now been reorganised with the result that new experiments will be laid down at these stations in the next planting season. Experiments towards improving methods of cultivation have led to no definite results, but will be continued at these stations.

The work of the more important stations during the last padi season are summarised below.

### Titi Serong Padi Experiment Station, Krian.

This station, comprising 21 acres of padi land, is situated in the Krian irrigation area—the most important rice growing district in the Federated Malay States.

Selection experiments are chiefly concerned with two popular types of padi, Seraup—an eight-month variety which normally gives heavy crops and has a good milling type of grain and Radin—a six-month variety, yielding fair crops and is the more favoured as a rice by the Malays.

* Abstract of a Summary prepared by the Economic Botanist, S.S. and F.M.S. on "Padi Experiments conducted in the S.S. and F.M.S. during the Season 1929-1930.

In addition to the Seraup and Radin selections, a collection representing all the chief varieties of padi grown in Malaya is maintained. This collection of "foundation stocks," numbering some 250 lines, contains several very promising types. Popular types of padi found in different rice growing areas throughout the country are sown from bulked seed at Titi Serong and then subjected to line selection, the most promising lines then being returned to their district for field trials—often with satisfactory results although under Krian conditions they may be only of average utility.

An experiment to test the relative adaptability of mixtures of the best pedigree strains was initiated in the last season; good crops were obtained. Possibly in a bad season, seed mixtures of the best strains might prove advantageous in comparison with seed of a single pedigree strain.

The technique of hybridisation of padi has been perfected and crosses made in an endeavour to combine the better characteristics of the best strains isolated by selection.

The Titi Serong Experiment Station has been used in the past as a seed distributing centre, and this function of the station will be continued for the present. During and after the last padi season, 45 tons of seed padi were purchased for seed distribution in the coming season when efforts will be concentrated on improving the yields in the two poorest producing areas of the Krian District. The District Officer will undertake to be responsible for the organisation of distribution in his district.

Other work performed at this Station was concerned with manurial experiments, studies of padi pests, and the compiling of meteorological data. The station was also used as a training centre for Padi Inspectors.

## Pulau Gadong Padi Experiment Station, Malacca.

Tihs station is situated five miles from Malacca town and consists of 25 acres of average padi land.

The station is designed to carry out experiments on selection, manuring and cultivation of padi, with the object of improving crop yields in Malacca territory.

The chief varieties of padi found in Malacca are Padi Nachin and Padi Siam and line selection work has been in operation with these varieties for some years. Strains of padi Nachin Puteh, Siam, Radin, Siak, and several varieties derived from the Titi Serong Experiment Station are under test of the Station, some of which have given most promising results.

Manurial experiments have been in operation for six years. In the season under review the crops were heavy in all plots, probably because irrigation was perfected and rat damage minimised. The results to date are inconclusive, but there appear to be indications that slow-acting phosphates are beneficial. Manurial experiments included comparisons of the different methods of application.

Cultivation experiments were continued but no significant results have yet been obtained.

### Talang Padi Test Station, Kuala Kangsar.

This area of 25 acres has been utilised for the past six years for comparing the effects of elementary manures on the growth and yields and also for testing various types of padi. The manurial experiments have been in progress for six years. As in Malacca, no definite results have yet been obtained from this work. Six varieties of padi were tested in the past season and gave satisfactory yields.

Other padi test stations are Pekan Darat, Province Wellesley; Bukit Merah, Butterworth; Dong Padi Test Station, Pahang; Temerloh Padi Test Station, Pahang; Pekan Wet Padi Test Station, Pahang; and Jelebu Demonstration Plot. At these stations, work was principally concerned with the introduction of strains of padi suitable to the particular conditions of the district; manurial and cultural work and demonstrations.

### Manuring Experiments—General.

Regarding the manurial experiments of padi, the very small response over a number of years at Malacca and the not very great response at Talang are most interesting in view of the results of similar work in other countries where increases up to 100% are claimed. In some countries, large increases have been obtained, but on very poor initial yields, whereas in this country, both experimental stations are capable of good yields without the aid of manures. This would indicate that our rice soils, possibly because of their heavier texture, supply of themselves better conditions of growth to meet the plants' requirements than do those of other countries.

It also indicates that one or more limiting factors, untouched by our manuring, are in play. Such factors might include aeration, bacteria, fungal or algal flora, absence of some of the elements—such as iron or magnesium—in available form, or water supply. Further, it might indicate that our manures have been applied at too late a stage in the development of the plant.

In Java, the richer and more efficiently irrigated padi fields which normally produce good crops shew but small response to manuring, whereas poor soils or soils liable to variations in water supply or which suffer from drought have been found to respond to manuring. To some extent the same observations have proved true in Malaya, where crops treated with phosphates mature early and show more resistance to drought than do untreated crops.

In the light of past experience, the Departmental Manurial Committee has recently drafted a new scheme for manurial experiments of padi which is designed to give accurate and statistically significant results. The lay-out of these experiments will be standardised as far as may be compatible with local conditions. Local methods of cultivation will be followed and precautions taken to reduce the experimental error to a minimum.

# THE THIRD IMPERIAL ENTOMOLOGICAL CONFERENCE.

**London, June, 1930*.**

The Third Imperial Entomological Conference was held in London under the auspices of the Imperial Institute of Entomology (formerly titled the Imperial Bureau of Entomology) on June 15-27 of this year. The meetings were held at 41 Queen's Gate, the Headquarters of the Entomological Society of London. About 40 delegates, representing twenty-four different states of the British Empire, attended in an official capacity†. Lord Buxton, the Chairman of the Managing Committee of the Institute, who was unavoidably absent, was represented by Sir Sidney Harmer at the opening meeting.

Mr. A. Gibson, Dominion Entomologist of Canada, showed a remarkable film representing the various phases of the mass production work and the behaviour of the principal parasites of the European Corn Borer as carried on in the laboratory at Chatham, Ontario.

An interesting discussion took place concerning tsetse fly control. Mr. C. F. M. Swynnerton, whose work in areas infested by tsetse is well known, gave a detailed account of the work in Tanganyika, where the practice of grass burning, carried out under skilled direction and combined with the breaking up of the infested zones into areas of a size convenient for burning, has given excellent results. A very important phase of this work has consisted in the production of live fences or hedges designed to prevent the passage of game and produced by the planting of cuttings or live poles of certain species of indigenous trees which are used by the natives to fence their villages. Other important developments in this work are the use of moving baits smeared with tangle foot for the capture of individual flies and the introduction of the aeroplane for scouting work. The subject of game preservation was included in this discussion.

Mr. B. P. Uvarov, of the Imperial Institute of Entomology, one of the foremost living authorities on locusts, opened a discussion on the subject of locusts. Unanimous agreement was expressed as to the necessity for further investigations on the permanent breeding grounds of the migratory locusts and the underlying causes of the phenomenon of migration.

Among other subjects discussed were the organisation of entomological departments, entomological work among backward races, the control of insects by cultural methods, particularly against sucking insects, and on orchard pests in various parts of the world.

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* Abstract of a Résumé of the Proceedings of the Third Entomological Conference, June, 1930 by Dr. W. R. Thompson, Assistant Director, Imperial Institute of Entomology and Superintendent, Farnham House Laboratory; published in *Nature*, July 26, 1930.

† Mr. G. E. Mann, Agricultural Instructor was the delegate representing Malaya.

The delegates visited the University of Cambridge and were shown the work conducted by the Department of Entomology and the important investigations on virus diseases of plants. They also visited Messrs. Chivers' Fruit Farm; the Rothamsted Experimental Station and Pathological Laboratory of the Ministry of Agriculture at Harpenden and the Parasite Laboratory at Farnham Royal, Bucks.

A day was devoted to the subject of biological control which is now of especial interest owing to the fact that since the previous Conference, the Imperial Institute of Entomology has founded—with the aid of a grant from the Empire Marketing Board—its laboratory at Farnham Royal as an Imperial centre for work on biological control of insect and plant pests. At the morning meeting, the biological control of insects was considered. It was opened by Mr. A. Gibson, who gave a detailed account of the work in progress on these lines in the Dominion of Canada. In the discussion that followed, many points were brought up concerning the practice of biological control of insect pests in various parts of the world, and general satisfaction was expressed by all the delegates in regard to the initiative which Sir Guy Marshall, Director of the Imperial Institute of Entomology, had taken in the creation of a special institution for work of this type within the Empire. The afternoon meeting was devoted to the subject of control of weeds by insects. Dr. Miller, of the Cawthron Institute of New Zealand, who opened the discussion, gave an account of the work which is being carried on in New Zealand in collaboration with the Imperial Institute of Entomology at Farnham Royal on the biological control of some of the most important weeds of New Zealand, including particularly blackberry, gorse, ragwort, and bracken. He was followed by Dr. A. Nicholson, deputy chief of the Entomological Division of the Commonwealth Council for Scientific and Industrial Research of Australia, who described the successful experiments carried on by the Commonwealth Prickly Pear Board against the various species of prickly pear in Australia. He showed that the initial successes obtained in this work have now been very greatly extended, and that large areas formerly rendered uninhabitable and useless for agricultural purposes by the invasion of the prickly pear have now been freed completely from this pest and are being brought under cultivation.

An official dinner was given to the delegates at Lancaster House, St. James's, by His Majesty's Government under the Chairmanship of Lord Passfield, Secretary of State for the Colonies.

# Reviews.

## Progress of Co-operation in Malaya.

Two Annual Reports* signed by Mr. A. Cavendish, Director of Co-operation, Federated Malay States and Straits Settlements not only give an account of the work of the Department during the year 1928-1929, but enable the reader to envisage the progress of the movement in Malaya since its inception. The Federated Malay States Department was founded in 1922, the organisation being extended to the Straits Settlements three years later. In addition, there exist Societies in the Unfederated States of Kedah and Perlis that, although not being under the Department, look continually to that organisation for advice and guidance.

Progress during the first few years of the adoption of this policy of co-operation might perhaps be considered slow by those who do not realise the many initial difficulties to be surmounted. The Director has rightly adopted a cautious policy because, no doubt, he realised that local experience was invaluable, and it is therefore unwise to launch a large number of societies without appreciating the possible difficulties that may be encountered. Perhaps an even more important reason for caution is the paramount necessity of educating the masses in the principles of co-operation. In this latter matter, the Department has carried out considerable work, thus paving the way for a more general appreciation of the benefits of co-operation and a consequent rapid extension of the movement.

The four main lines of progress in the establishment of co-operation in Malaya have been Rural Credit Societies, Thrift and Loan Societies, Indian Estate Labourers Co-operative Societies, and Co-operative Rubber Factories.

*Rural Credit Societies.*—Seventy-nine Societies are now in existence in the Federated Malay States with a membership of 2,538 and a working capital of $135,609. Fourteen such Societies are established in the Straits Settlements with a membership of 461 and a capital of $10,575. This branch of the work of the Department made no rapid strides during the year. It is pointed out that not only had disloyal members to be weeded out, but that the wasteful customs and habits, deep rooted in the usage of centuries, cannot be eradicated in a day and the process of rural regeneration must necessarily be slow.

*Thrift and Loan Societies.*—These Societies all show signs of vigour and healthy activity, and continuous and steady progress has been made. The Director, however, points out that the need for the education of committees and members in co-operative practice and principles is still very real and ever present. The present strength of this movement in Malaya is as follows:—

* Federated Malay States Annual Report on the Working of Co-operative Societies for the Financial Year ending 30th June, 1929. *F.M.S. Government Press*, 1930; and Straits Settlements Annual Report on the Co-operative Societies for the year 1928-1929. *Government Printing Office, Singapore, 1930.*

F.M.S. 26 societies, 14,120 members, $2,278,795 working capital
S.S. 15 societies, 5,472 members, $ 389,244 working capital

*Indian Estate Labourers' Co-operative Societies.*—This is a more recent extension of the co-operative movement in the Federated Malay States and one in which substantial progress has been made. Twenty-one new societies were registered. On 30th June, 1929, 33 societies existed. Membership rose from 2,330 to 7,104. Paid-up share capital increased from $22,720 to $74,128 and the working capital amounted to $75,888.

*Co-operative Rubber Factories.*—An account of the formation of these societies was given in some detail in *The Malayan Agricultural Journal*, April, 1930, so that re-iteration in this place is unnecessary. We await a review of the result of the year's work of the first factory opened with considerable interest.

Co-operation began in this country about eight years ago. Since that time 190 societies comprising 37,500 members have acquired a paid up capital of over $3 millions, and granted loans of over $9 millions, of which $7½ millions have been repaid. Their cash and investments stand at about $2 millions, while their losses are infinitesimal. As will be seen from the foregoing, the bulk of this financial prosperity of the Societies relates to Thrift and Loan Societies which have made very steady progress. The work of the Rural Credit Societies has been much slower and uncertain, but one must not on this account deny the infinite possibilities of further organisation in this direction.

D. H. G.

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## An Historical Note on *Tirathaba rufivena* Walk. (The Greater Coconut Spike Moth) and Its Three Parasites in Malaya.

BY

G. H. CORBETT

and

## Preliminary Observations on *Sogata* spp., Pests of Padi

BY

N. C. E. MILLER AND H. T. PAGDEN.

*Special Bulletin, Scientific Series No. 3, Department of Agriculture, S.S. and F.M.S. Price 50 cents, (Straits Settlements Currency).*

The Author of the first of these two papers gives the history of the work of identification of *Tirathaba rufivena* Walk. in Malaya and other countries. In addition, an account is given of the three known parasites of this pest; viz. *Nemeritis palmaris* Wilk., *Apanteles tirathabae* Wilk., and *Erycia basifulva* Bezzi, with observations on the incidence, method of attack, the chances of successfully introducing the parasites to other countries, and the comparative utility of each in the control of the pest. A bibliography of literature cited completes the historical survey.

The reader will better appreciate from this account the efforts that are being made successfully to use biological control methods and the amount of liaison between workers in different countries towards this end.

In the second paper, Messrs. Miller and Pagden describe the incidence, life history and control of *Sogata* spp., pests of padi. Outbreaks occur from time to time and occasion considerable damage to padi. Study of this pest is rendered difficult as the attacks appear and disappear with suddenness. The writers are of opinion that the degree of humidity is the determining factor of these outbreaks and advocate for their control the running off of the water from the attacked areas where this practice is possible.

D. H. G.

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## Investigations on Panama Disease in Malaya

BY

F. S. WARD.

*Special Bulletin, Scientific Series No. 2. Department of Agriculture, S.S and F.M.S. 26 pp. 4 plates; price $1 (Straits Currency) Government Printing Office, Kuala Lumpur.*

The first conclusive evidence of the presence of Panama disease in Malaya was obtained in 1927 when *Fusarium cubense* was isolated from wilted Pisang Restali in Johore. As a result of the further investigations described in this paper the author has found that the disease may occur in this country in one of two forms, which he differentiates as acute and chronic. The acute form, which tends to develop in neglected cultivations and is usually associated with plants approaching maturity, rapidly proves fatal. On the other hand, the progress of the disease in the chronic form is slow. The affected plants become stunted, but may eventually produce fruit bunches; the development of these is, however, much delayed, and the fruits, which are few in number, often fail to ripen.

In confirmation of experience elsewhere the author finds that the incidence of the disease is heaviest during or just following the rainy season, particularly in areas which are inadequately drained.

Experiments conducted with five physiologically distinct strains of *Fusarium cubense* have shown that a negative correlation exists between growth rate and temperature. This observation is of peculiar interest in view of the opinion held by some that the failure of Panama disease to develop on the irrigated lands in Jamaica and Colombia is due to the high soil temperatures prevailing under such conditions.

Extensive inoculation experiments with three strains of *Fusarium cubense* and with a bacterium resembling *Pseudmonas musae* are described. Pisang Rajah, Pisang Serendah (*M. Cavendishii*) and Pisang Mas appear to be immune or highly resistant to Panama disease, as also are the indigenous species of Musa (*M. malaccensis* and *M. violescens*). Pisang Embun (which is thought to be the same as the Gros Michel of the West Indies) Pisang Restali and Pisang Talon have proved susceptible.

The morphological and physiological characteristics of four Malayan strains of *Fusarium cubense* are described in detail.

R.A.A.

# Miscellaneous.

## AGRICULTURAL SHOW, TEMERLOH.

A very well attended Show was held at Temerloh on Saturday, the 27th September, 1930. Exhibits were numerous, more especially in the cereals section which comprised about 1200 exhibits of padi and rice and the largest collection of maize cobs seen at any Show for some time. A factor which detracted somewhat from the value of a portion of the padi exhibits was that local padi growers did not appear to understand that exhibits entered for a class intended for one variety of padi only should be confined to that variety. The number of maize exhibits, which was well over 100, bore eloquent testimony to the increasing popularity and importance, since the 1926 floods, of maize as a supplementary food crop in the District.

The section for the produce of school gardens contained some good exhibits of oranges, bananas and yams; a fairly large collection of good clean samples of kapok fibre; numerous specimens of coconut oil; and of sugar and rope from the sugar palm. In the Arts and Crafts Section, baskets and mats were most in evidence. A number of village fowls and fairly numerous exhibits of eggs were conspicuous features of the Livestock Section.

The Forest Department displayed a collection of timber samples and of rotans. The Rubber Research Institute staged an exhibit of rubber diseases and of bud grafting. Periodic demonstrations of the actual operation of grafting were also given by an experienced Malay Officer of the Institute and attracted much attention. The Department of Agriculture displayed educational exhibits dealing with the advantages of pedigree strains of padi and with insect pests of that crop, rat destruction, faults in copra production, marasmius disease of coconut petioles, specimens of tea from the Government Plantations at Serdang and Cameron's Highlands; and vernacular publications for distribution. The exhibits connected with padi proved so popular that two Malay Officers of the Department were kept fully occupied in explaining them and answering questions.

The keen interest displayed by Malay visitors and competitors both in the educational exhibits and the competitive sections gave evidence of the value of the Show as a means of improving agricultural practice in the District.

# ENTOMOLOGICAL NOTES.

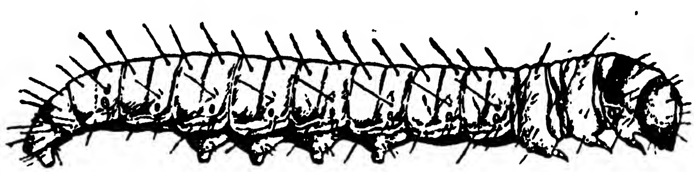
## Third Quarter, 1930.

### Oil-Palm.

The first occurrence of a caterpillar damaging the fruits of the oil-palm in Malaya has recently been recorded. Two bunches, containing 1213 developed fruits, showed 368 fruits with damaged pericarp, of which 172 contained no kernel. In some cases, the kernel had been destroyed by the caterpillar, but in the majority it appeared to have been broken down by bacteria penetrating the hard shell. Fruits which have been completely ringed at the base by the caterpillar have been observed.

Observations will be continued to ascertain the economic importance of this insect and also to confirm the statement that only isolated bunches are damaged. At the time of writing, this caterpillar has only been reported from one estate which indicates either that it is not widely distributed or that injured fruits have not been observed elsewhere.

The full-grown caterpillar (v. plate below) is about 25 mm. in length, slightly hairy, dark with a reddish brown coloured head. The moth has not yet been obtained.



Managers of estates are asked to submit bunches of fruits in preference to fruits for examination in order to ascertain if this insect is generally present throughout Malaya.

" White ants " have again been troublesome on some oil-palm properties by working up through the trunk and finally destroying the bud.

Attention is drawn to the fact that after the operation of pruning, sufficient care is not always taken in disinfecting the cut-ends of petioles. This procedure is necessary essentially to prevent the red-stripe weevil (*Rhynchophorus schach* Oliv.) laying its eggs on exposed surfaces.

### Coffee.

The beetle berry borer—*Cryphalus hampei* Ferr.—has been reported from other coffee areas during the month. This is a most important enemy as it may reduce the yield of coffee to a negligible quantity. In severe attacks, the institution of a " dead " season when no coffee berries are allowed to mature is

essential for its control. It is advisable that introductions of berries should not be made on estates at present free of this pest, and that where berries have been imported, they should be carefully examined to see if they contain the beetle. All importations should be thoroughly inspected and should not be sown if the presence of this beetle is observed.

## Tuba.

A Chrysomelid beetle, tentatively identified as *Neolepta biplagiata* Jacoby, formed the subject of an enquiry as it has been responsible for considerable damage to the leaves of Derris. The eggs, larvae and pupae are found in the soil. The beetle is about three-sixteenths of an inch in length, head dark brown, thorax brownish yellow and the wing covers pale brownish with a irregular, broad dark brown band across the front portion.

The beetle readily succumbs to a spray consisting of pyrethum powder 1.67 lbs., soap 1.67 lbs., petroleum 0.8 gallons and water 40 gallons. The above quantities are considered to be sufficient for one acre. The total cost of application, including materials and wages, amounts to \$1.70—\$2.00 per acre. The spray would be reduced in cost and would possibly prove equally satisfactory if petroleum were omitted.

## Padi.

The investigation on the control of "borers" by the parasite, *Trichogramma nanum* Zehnt., has been continued. Two consignments of this parasite have been sent to Ceylon in the hope that it will eventually prove of value in controlling the Tea Tortrix.

Reports of the caterpillars of *Spodoptera mauritia* Boisd. damaging padi in the field have been received from most States in Malaya. This moth has never been reported as causing extensive damage to padi in the field. It generally confines its attention to nursery padi. The unusually dry weather is thought to have been conducive to increasing its range to padi in the field. Hand collecting of the caterpillars and turning ducks, which readily devour the caterpillars, on the padi fields, were practised and proved successful. Recent information indicates that the damaged padi will suffer no permanent injury.

## Coconuts.

Outbreaks of *Artona catoxantha* Hamps. have not been recorded. It has been suggested that since smoke has been thought to be a possible cause of outbreaks of this moth, incinerators should be removed from the immediate vicinity of coconuts or that coconut palms in the neighbourhood of incinerators should be cut out. Whilst some evidence seems to exist associating smoke with

outbreaks, the removal of one or the destruction of the other is not considered to be advisable. Until more definite evidence is available, however, it might be advisable to construct incinerators as far removed as possible from coconut palms.

## Miscellaneous.

"Tuba" used at the rate of 1 lb. to 10 gallons of water is a good insecticide for general use in the garden, as plants regularly sprayed will be kept comparatively free from mealy bugs, thrips, aphids and similar insects. The flowering of Vanda orchids is frequently disappointing. This is due entirely to the buds being killed by the incessant sucking of the sap by thrips. Maidenhair ferns and similar plants are often dwarfed in growth by mealy bugs; a tuba spray would be found very satisfactory in controlling them.

Borax is often used for cockroaches but sodium fluoride mixed with an equal weight of flour is more effective.

## General.

Mr. C. P. Clausen, Entomologist, Bureau of Entomology, U.S.A., who has been stationed in the Far East for about a year spending most of his time in Malaya, returned to America in August. He has been engaged sending importations of parasites for the control of the white fly—*Aleurocanthus woglumi*—of citrus to Cuba.

Mr. C. E. Pemberton, Entomologist, Sugar Growers' Association, Hawaii, arrived in Malaya in August for the purpose of introducing parasites of sugar cane insects into Hawaii.

The importance of the control of pests by parasites is emphasised by the departure and arrival of these two Entomologists.

## FROM THE DISTRICTS.

### The Weather.

In Kedah and Singapore Island an adequate rainfall was well distributed; in the northern half of Malacca heavy showers fell, but Jasin District continued to suffer from drought until the last few days of the month. Most of the country, however, experienced first a wet period of about ten or eleven days duration, then two weeks of dry weather, and finally a few wet days at the close of the month.

### Remarks on Crops.

*Rubber.*—The decline in the price of rubber continued; smoked sheet from small holdings sold for $10 to $16 and unsmoked sheet for $9 to $12 per picul. No definite reports of the closing down of estates have been received but in all parts of the country the number of untapped small holdings has increased considerably. In Negri Sembilan alone it is estimated that 2000 acres of such holdings are now untapped, while tapping is continued on a number of others only because they are the only source of livelihood either for the owners or their relatives. A certain proportion of the increase in the number of untapped holdings is due to the fact that their owners have been occupied with padi planting operations.

The continued movement of tappers is resulting in the further spread of Mouldy Rot Disease and is likely to cause an even wider and more rapid distribution of the fungus when the favourable damp conditions attending the rainy season become generally prevalent. A second "wintering" of rubber trees occurred in many localities during the month induced by the previous spell of drought. From two estates in Malacca reports were received of the reappearance of secondary leaf fall caused by *Oidium Hevea* which had previously attacked young leaves in March after the first "wintering". This disease was also found on an estate in Province Wellesley in which District its presence had not previously been definitely confirmed.

*Padi.*—Improved weather conditions enabled good progress to be made with planting operations in those districts where it was not already completed; the general prospect for the season's crop consequently has improved. Along the Perak river the land was still dry, but in some localities planting was done by dibbling the plants into the soil in the hope that rain would fall in time to enable them to make good growth. In view of the possible failure of the wet padi crop in the river areas of Pahang West, it has been supplemented to a certain extent by different forms of dry padi cultivation.

There was an outbreak of army worms *Spodoptera mauritia* on young planted padi in a few localities in Malacca, but the pests disappeared entirely from all

the areas in which attacks occurred during the month of August. Further outbreaks of the Pentatomid bug *Scotinophara coarctata*, M. Kutu Bruang or Bena Kura have occurred in situations where padi has suffered from drought. All three species of stem borers would also appear to be generally distributed and have occasioned considerable loss in some places. In Kedah a satisfactory method was found for trapping crabs which had destroyed whole fields of newly planted padi in one area.

*Food Crops.*—The Malays living along the Pahang river have planted up a very large area with maize, tapioca, beans and other food crops in addition to the areas of hill padi which have been or are being planted. The river banks, islands, State Land on Temporary Occupation Licence and land already given out for rubber cultivation have been utilised for this purpose. Some excellent crops of maize have already been harvested. This alternative food supply should help to reduce the danger of food shortage presented by the uncertainty of the wet padi crop.

In Kedah a crop of maize planted with hill padi was reaped from an area of 71 acres in one locality, while in Province Wellesley good crops of tapioca, sugar cane and vegetables were obtained.

In Negri Sembilan a number of small areas of vegetables have been planted recently chiefly for consumption by their owners. Efforts are being made to get more maize, tapioca, yams and sweet potatoes planted, but weather conditions recently have not been favourable.

*Fruit.*—An early season was being experienced in the coastal districts of Selangor where durians, mangosteens and rambutans were available in small quantities. In other districts of this State there was a general shortage. The supply in the Kuala Lumpur market came largely from Malacca and consisted mainly of langsat, duku and rambai. The fruit seasons this year appear to to be very irregular in several parts of the country.

Large numbers of water melons have been taken from the Dindings for sale on the Penang markets.

*Tobacco.*—In the Baling District of Kedah a small tobacco industry has been established. The area under cultivation is 220 acres. The produce is all sold locally and used in the manufacture of cigars. The present price paid for dried leaves is $20 to $25 per pikul.

Great interest is being taken in the effort of this Department to establish tobacco as a catch crop or rotation crop in Chinese market gardens in Province Wellesley and there have been many applications for seed. The nursery beds sown at Permatang Pauh and Sungei Rambai were showing good growth and doing well.

*Tea.*— There has been a further drop in prices for local Chinese tea in Selangor, the best quality now realising 65 cents per kati. On small holdings some interest has been taken in soil conservation as a result of departmental leaflets recently issued and of lectures and advice given by the Chinese Sub-

Inspector of Agriculture. Silt pitting and the planting of cover crops is now being undertaken by some cultivators at Sungei Balak.

*Tuba.*—An estate in Pahang now has 1050 acres planted with this and other crops from which insecticides can be prepared.

*Cloves and Nutmegs.*—In the Settlement of Penang nutmegs are in bearing but cloves are not yet flowering. The clove gardens are receiving more than usual attention.

## Notes on Demonstration Stations and Padi Test Plots.

*Kedah Rice Experiment Station.*—Good progress was made with the preparation of the land for planting in October. The nurseries required constant attention owing to the attacks of various pests.

*Pulau Gadong Padi Experiment Station, Malacca.*—An additional area of 3½ acres of land with road frontage has been purchased and added to this Station. The addition of this land has greatly improved the appearance of the Station. It has been used this season for preliminary experiments in mechanical cultivation.

*Bukit Merak Padi Test Plot, Province Wellesley.*—Heavy rain at the beginning of the month enabled good progress to be made with the work of preparing this land for planting.

In Selangor, insect pests, mainly stem borers, have caused damage at the Kuang plot, while parts of the Kajang plot have suffered from lack of water. In Pahang growth on the Temerloh plot has also been affected by drought. On the Alor Gajah plot in Malacca the transplanted padi was severely attacked by army worms, *Spodoptera mauritia,* which were controlled by hand picking and by spraying with tuba root solution.

*Kuala Lipis Demonstration Station.*—One plot of ground nuts was harvested and four varieties of sweet potatoes were planted. A system of bunds was constructed to conserve the soil.

*Sungei Udang Demonstration Station, Malacca.*—The work of felling jungle and clearing 16 acres of this site was commenced.

*Pineapple Experiment Station, Singapore.*—Preliminary work in connection with the establishment of this Station has been commenced on the site at Lim Choo Kang. Details and lay-out of four sets of experiments on manuring, cultivation, rotation and green dressings, and planting distances have been arranged. Plans for buildings have been prepared and a road survey has been made. Erection of the buildings is expected to commence in the near future.

## Plant Distribution.

Among the usual distributions of planting material during the month, mention may be made of the supply of considerable quantities of seed of a good variety of Australian maize to school gardens and small-holders in Province Wellesley, and of seed of four varieties of maize from the Government Experimental Plantation, Serdang to the Singapore Cold Storage Dairy Farm for trial

as fodder. Other distributions included planting material of yams, sweet potato, tapioca, maize, and various vegetables to school gardens and small-holders in different parts of the country, together with some mixed fruit seedlings from Serdang for the Jurong District of Singapore.

## Rats.

In Province Wellesley 122,731 rat tails were purchased and 51,600 poison balls were distributed. In Krian rewards were paid for 259,792 tails, and 51,479 poison balls were supplied. In Selangor a small meat mincing machine proved very satisfactory in the preparation of 1 1/5 tons of poison balls of which 1472 lbs. have already been distributed for use in padi fields. Where used, the balls have been readily taken by rats. Elsewhere there has been a good demand for rat traps and supplies of poison at cost price.

# DEPARTMENTAL NOTES.

## Visit of H.E. The Governor.

His Excellency, Sir Cecil Clementi, K.C.M.G., Governor and Commander-in-Chief of the Straits Settlements and High Commissioner of the Malay States, visited the Government Experimental Plantation, Serdang, Selangor on 20th September, 1930.

## Visit of H.R.H. Prince Purachatra of Siam.

H.R.H. Prince Purachatra, Minister of Commerce and Communications, Siam, visited the headquarters of the Department of Agriculture at Kuala Lumpur on 13th September, 1930.

## The Director of Agriculture visits Malacca.

The Director of Agriculture, as Chairman of the Committee for the Extension of the Cultivation of Rice in Malaya, accompanied the Committee on a visit to Malacca on 1st and 2nd September, 1930.

## Delegation of Rice-Production Committee visit the Northern Rice Areas.

The Director of Agriculture, the Hon'ble Dato Rembau, Mr. C. W. Maxwell and Dr. H. W. Jack who form the visiting delegation of the Committee for the Extension of the Cultivation of Rice, proceeded on the 21st September, 1930, on a tour of the northern rice-producing areas of Malaya. The Delegation visited the rice-growing areas of Krian in Perak, Province Wellesley, Kedah, Perlis and Siam. The tour was completed on October 6th.

## Demonstrations to Chinese at the Government Experimental Plantation, Serdang.

A party of Chinese agriculturists from Kepong, Selangor, attended a demonstration at the Experimental Station, Serdang on August 5th, 1930. A somewhat similar demonstration was given on September 9th. to a party of Chinese agriculturists from various districts around Kuala Lumpur. As usual, these demonstrations were much appreciated, considerable interest being maintained throughout the tours.

## Departmental and Inter-Departmental Agricultural Conference, 1930.

Arrangements are in hand for the holding of a Conference of Officers of the Department of Agriculture in Kuala Lumpur from October 27th. to November 1st. 1930. It is hoped that officers of the Rubber Research Institute of Malaya,

the Co-operative Department and the Veterinary Department will also attend the Conference.

It is expected that the Conference will be opened at 10 a.m. on October 27th. by the Hon'ble the Chief Secretary to Government, to be followed by an address by the Director of Agriculture. The public are invited to the opening, but subsequent proceedings will be private. At the conclusion of the Conference, a statement of the proceedings will be made public, and it is also hoped to publish in *The Malayan Agricultural Journal* certain of the papers read at the Conference.

## Vernacular Publications.

Two leaflets in the Vernacular have recently been issued by the Department. "Soil Erosion: what it is and how it can be guarded against" has been published —with illustrations—in both Malay and Chinese. A total of nearly 5,000 copies have been distributed throughout Malaya. The second leaflet, prepared by the Rubber Research Institute of Malaya on "Notes on the Care of Rubber Trees, Tapping, Preparation of Rubber &c. for Small-holders," has also been published in Malay and Chinese; 6,000 copies of which will be similarly distributed throughout the country. These articles will also be reprinted in the quarterly journals of the Department in Malay and Chinese, of which 5,000 copies of each are published. In this way, very wide circulation of information on these two important subjects will be achieved.

## Leave.

Major C. D. V. Georgi, O.B.E., Acting Agricultural Chemist, has been granted 5 days full pay leave from 13th. September, 1930 to be followed by 3 months 25 days half-pay leave from 18th. September, 1930 on the ground of ill-health.

Mr. V. R. Greenstreet, Assistant Agricultural Chemist, has been granted 9 months 12 days full-pay leave from 12th. September, 1930 to be followed by 2 months 15 days study leave on full pay from 24th. June, 1931.

## MARKET PRICES.

### September, 1930.

*Rubber.*—The market price of rubber continued to decline steadily throughout the month. The highest price in Singapore was 15¼ cents on September 1st; the lowest on September 30th, when it stood at 11½ cents per lb. The highest price in London was 4⅝d. on September 1st, while the lowest on record was on September 30th when it reached 3⅞d. The average price in Singapore for month was 12.8 cents., in London 4.09d, compared with 15.55 cents. and 4.84d. respectively in August.

*Copra.*—The average Singapore prices of copra for September were; sundried \$6.57; mixed \$6.39; compared with \$7.11 and \$6.89 per picul in August. Copra cake averaged \$2.13 per picul in September. While prices continued to decline, the market has remained active, and supplies have shewn no signs of falling off.

*Gambier.*—Singapore average prices for September were: Block \$9.70, Cube \$14.35. The previous month's averages were \$9.40 and \$14.34 per picul respectively. Latest information is to the effect that the demand is poor and prices tend to decline.

*Nutmegs.*—Average prices in Singapore for September were: 110 per lb. \$25; 80 per lb. \$29.20 per picul compared with \$25.62 and \$30 respectively in August.

*Mace.*—Siouw averaged \$63.80 per picul; Amboina \$39.90 per picul on the Singapore market. The corresponding prices in August were \$62.70 and \$33.17.

*Pepper.*—Singapore average prices were: Black \$21.45; White, Rio and Sarawak \$30.50; Muntok, white, \$31.40 per picul. In August the corresponding average prices were \$22.09, \$30.81, \$30.17. The market has firmed following the London advance and an improved demand from Eastern Ports.

*Sago.*—Singapore average prices for September were:—Flake, small, fair, \$6.22½ per picul compared with \$6.45½ in August; Flour, \$2.96 per picul compared with \$3.04 in August. Supplies continue to be full and prices tend to decline.

*Tapioca.*—September average prices in Singapore were:—Flake, small, fair, \$4.13; Pearl, seed, \$5.42½; Pearl, medium, \$5.75. Corresponding prices in August were \$3.86, \$5.50, \$5.75 per picul. Moderate transactions are reported, prices throughout the month being steadier.

*Pineapples.*—Average Singapore prices in September: 1½ lb. cubes \$3.80; 1½ lb. sliced, flat, \$3.68; 1½ lb. sliced, tall, \$4.23, compared with \$3.60, 3.60, and \$4.18 per case in August. The demand is negligible and very little business is reported.

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The above market prices are based on the daily cabled London quotations and the Singapore quotations for rubber; on the Singapore Chamber of Commerce Market Reports from 30th August to 27th September and on other local sources of information.

1 picul = 133⅓ lbs.

The dollar is fixed at two shillings and four pence.

## FEDERATED MALAY STATES.

### RUBBER CROP AND TAPPING STATISTICS FOR 1929 OF ESTATES OF 100 ACRES OR OVER.

| State. | Total Area planted with mature tappable rubber. | Average area tapped. (A) | Average area rested. | Percentage of tappable area rested. | Average number of days upon which tapping was done. | Crop harvested from tapped area. (Col. A.) | Average yield per tapped acre, per year. | Notes. |
|---|---|---|---|---|---|---|---|---|
| | Acres. | Acres. | Acres. | | | Pounds. | Pounds. | |
| Perak ... | 231,029 | 212,100 | 18,929 | 8.19 | 348 | 102,117,120 | 481.64 | |
| Selangor ... | 278,904 | 240,300 | 38,604 | 13.84 | 350 | 120,704,640 | 502.30 | |
| Negri Sembilan | 204,547 | 188,310 | 16,237 | 7.94 | 349 | 88,533,760 | 470.15 | |
| Pahang ... | 29,417 | 25,710 | 3,707 | 12.60 | 347 | 12,499,200 | 486.16 | |
| Total | 743,897 | 666,420 | 77,477 | 10.64 | ... | 323,854,720 | 485.06* | |

*The average yield in 1927 was 420 lbs. and that in 1928 was 436 lbs.

J. GORDON-CARRIE,

Deputy Registrar-General of Statistics,

S.S. and F.M.S.

## STRAITS SETTLEMENTS.

### RUBBER CROP AND TAPPING STATISTICS FOR 1929 OF ESTATES OF, 100 ACRES OR OVER.

| Territory. | Total area planted with mature tappable rubber. | Average area tapped. (A) | Average area rested. | Percentage of tappable area rested | Average number of days upon which tapping was done. | Crop harvested from tapped area. (Col. A.) | Average yield per tapped acre, per year. | Notes. |
|---|---|---|---|---|---|---|---|---|
| | Acres. | Acres. | Acres. | | | Pounds. | Pounds. | |
| Malacca | 100,149 | 86,450 | 13,699 | 13.68 | 324 | 36,321,600 | 420.15 | |
| Pro. Wellesley | 41,205 | 35,812 | 5,393 | 13.08 | 336 | 14,300,160 | 399.31 | |
| Dindings | 5,676 | 5,360 | 316 | 5.57 | 348 | 2,636,480 | 491.88 | |
| Total 12 Months | 147,030 | 127,622 | 19,408 | 13.20 | ... | 53,258,240 | 417.31* | † Approx: rate per Year. |
| Penang ‡ | 1,374 | 1,100 | 274 | 19.94 | 346 | 181,440 | 164.95 † | 329.90 |
| Singapore ‡ | 29,637 | 24,200 | 5,437 | 18.31 | 340 | 3,577,280 | 147.82 † | 298.64 |
| Total 6 Months | 31,011 | 25,300 | 5,711 | 18.42 | ... | 3,758,720 | 148.57 | |

‡ **Notes**:—The figures for the Islands of Penang andSingapore are for the **six** months ending December, 1929. For periods earlier than 1st July, 1929 the information is not available.

*The average yield in 1927 was 350 lbs. and that in 1927 376 lbs.

J. Gordon-Carrie,
Deputy Registrar-General of Statistics,
S.S. and F.M.S.

# MALAYA RUBBER STATISTICS.

**Stocks of Rubber, including Latex, Concentrated Latex and Revertex held by Dealers and Estates of 100 Acres and Over, the Declared Production of the same Estates, Imports and Exports, and the Estimated Production of Estates of Less than 100 Acres, for the Month of August 1930, in Dry Tons.**

| Territory | Stocks at beginning of month | | | Production by estates of 100 acres and over | | Production by estates of less than 100 acre (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | during the month | | during the year 1930 | | during the month | | during the year 1930 | | | | |
| | Ports | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | Foreign | From Malay States | Foreign | From Malay States | Foreign | Local | Foreign | Local | Dealers | Estates of 100 acres and over | Ports |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **Malay States** | | | | | | | | | | | | | | | | | | |
| Federated Malay States ... ... | ... | 9,831 | 15,320 | 13,953 | 88,432 | 10,238 | 74,869 | Nil | 5 | Nil | 47 | 17,539 | 6,124 | 121536 | 42,842 | 10,302 | 15,382 | ... |
| Johore ... ... | ... | 2,043 | 4,964 | 4,519 | 27,290 | 4,494 | 32,003 | Nil | 2 | Nil | 14 | 1,431 | 7,225 | 8,072 | 51,824 | 2,069 | 5,297 | ... |
| Kedah ... ... | ... | 418 | 2,241 | 2,404 | 15,007 | 1,276 | 9,995 | Nil | Nil | 30 | Nil | 873 | 2,604 | 5,620 | 19,283 | 475 | 2,387 | ... |
| Perlis ... ... | . | 7 | 10 | 10 | 67 | 8 | 109 | Nil | Nil | Nil | Nil | Nil | 20 | Nil | 193 | 7 | 8 | ... |
| Kelantan ... ... | ... | 144 | 158 | 316 | 1,922 | 310 | 3.080 | 4 | Nil | 30 | Nil | 91 | 589 | 549 | 4,590 | 144 | 108 | ... |
| Trengganu* ... | ... | 55 | 50 | 102 | 924 | 51 | 462 | Nil | Nil | Nil | Nil | Nil | 153 | Nil | 1,387 | 55 | 50 | ... |
| **Straits Settlements** | | | | | | | | | | | | | | | | | | |
| Malacca ... ... | ... | 2,328 | 1,775 | 1,461 | 9,318 | | | Nil | 2,676 | Nil | 12,686 | 4,640 | | 30.387 | | 2,461 | 1,951 | ... |
| Province Wellesley | ... | 121 | 733 | 618 | 3,487 | | | | | | | | | | | 145 | 702 | ... |
| Dindings ... ... | ... | 120 | 172 | 153 | 781 | †5,930 | 26,871 | 561 | 3,834 | 6,482 | 26,780 | 5,884 | Nil | 44,283 | Nil | 117 | 191 | ... |
| Penang ... ... | 1,524 | 4,869 | 15 | 11 | 82 | | | | | | | | | | | 5,953 | 14 | 1,197 |
| Singapore ... | 4,474 | 31,099 | 376 | 249 | 1,804 | | | 7,893 | 10,198 | 75,223 | 80,592 | 20,278 | | 163,622 | | 32,637 | 340 | 4,680 |

**Analysis of Colony, Federated Malay States and Johore Dealers' Stocks at End of Month, in Dry Tons.**

<table>
<tr><th>Class of Rubber<br>(20)</th><th>Federated Malay States<br>(21)</th><th>Singapore<br>(22)</th><th>Penang<br>(23)</th><th>Province Wellesley, Dindings and Malacca<br>(24)</th><th>Johore<br>(25)</th><th>Gross total<br>(26)</th></tr>
<tr><td>Smoked sheet ...</td><td>7,467</td><td>16,507</td><td>3,660</td><td>1,650</td><td>900</td><td>30,184</td></tr>
<tr><td>Crepe ... ...</td><td>608</td><td>13,798</td><td>1,438</td><td>711</td><td>199</td><td>16,754</td></tr>
<tr><td>Unsmoked sheet ...</td><td>1,048</td><td rowspan="2">2,332</td><td rowspan="2">855</td><td rowspan="2">362</td><td>574</td><td rowspan="2">6,746</td></tr>
<tr><td>Scrap and lump ...</td><td>1,179</td><td>396</td></tr>
<tr><td>Total all Grades ...</td><td>10,302</td><td>32,637</td><td>5,953</td><td>2,723</td><td>2,069</td><td>53,684</td></tr>
</table>

*Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19)—(2)—(3)—(4)—(5)—(9)—(10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated 10 Sept., (S. S. *Gazette* Not. No. 1868), being dry weight as estimated by Dealers themselves.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I. & E. 5, dated September 4, (S.S. *Gazette* Not No. 1815), foreign wet imports being reduced to dry weight by 25 per cent.

6. Foreign exports of each State and Settlement are those published in the Malaya Monthly Trade-Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I. and E. 4, dated September 4, *Gazette* Not. No. 1814 Appendix IV to Monthly Trade Return).

*7. Stocks and production in Trengganu are estimated from figures supplied by the Commissioner of Lands.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.

†9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the Columns comprising it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

Singapore, September 19, 1930.

J. I. Miller, M.C.S.,
*Acting Registrar-General of Statistics, S.S. and F.M.S.*

# SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS, FOR THE MONTH OF AUGUST, 1930.

| State | District | Acreage of padi land | Acreage planted | Percentage 4 to 3 | Gross crop | Crop per acre 6 to 4 | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | Gantangs | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Perak** | Perak North : | | | | | | |
| | Krian | 53,250 | ... | ... | ... | ... | 2000 acres planted. Preparation of Land in progress excepting mukims of Selinsing and Gunong Semanggol—10500 acres. |
| | Larut | 8,525 | ... | ... | ... | ... | Drought still holding up planting. Some of the nurseries sown early have suffered badly. |
| | Selama | 3,450 | ... | ... | ... | ... | |
| | Kuala Kangsar | 13,997 | ... | ... | ... | ... | Preparation of land and planting in progress excepting Bruas, Layang2, Bota Lambar Kiri and Kauan—6900 acres—where lack of water is holding up operations. |
| | Upper Perak | 3,739 | ... | ... | ... | ... | Planting in progress. |
| | Perak South : | | | | | | |
| | Six mukims | 14,187 | ... | ... | ... | ... | Transplanting completed. |
| | | 97,148 | ... | ... | ... | ... | |
| **Pahang** | West : | | | | | | |
| | Temerloh | 12,311 | ... | ... | ... | ... | Transplanting completed. |
| | Raub | 5,112 | ... | ... | ... | ... | Transplanting in progress. |
| | Kuala Lipis | 5,576 | ... | ... | ... | ... | Transplanting completed. |
| | Bentong | 783 | ... | ... | ... | ... | Transplanting completed. |
| | | 23,782 | ... | ... | ... | ... | |
| **Negri Sembilan** | Seremban | 4,904 | ... | ... | ... | ... | Transplanting started. |
| | Kuala Pilah | 17,931 | ... | ... | ... | ... | Transplanting in progress. |
| | Port Dickson | 159 | ... | ... | ... | ... | Transplanting in progress. |
| | Jelebu | 3,116 | ... | ... | ... | ... | Transplanting completed. |
| | Tampin | 2,609 | ... | ... | ... | ... | Transplanting in progress. |
| | Rembau | 7,897 | ... | ... | ... | ... | Transplanting in progress. |
| | | 36,616 | ... | ... | ... | ... | |

## SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS, FOR THE MONTH OF AUGUST, 1930.—(Continued).

| State or Settlement | District | Acreage of padi land | Acreage planted | Percentage 4 to 3 | Gross crop | Crop per acre 6 to 4 | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | Gantangs | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Selangor | Ulu Langat | 2,670 | ... | ... | ... | ... | Transplanting completed except in Beranang where transplanting is in progress. |
| | Kuala Langat | 797 | ... | ... | ... | ... | Transplanting completed except in Sungei Buloh where transplanting is in progress. |
| | Ulu Selangor | 1,205 | ... | ... | ... | ... | Transplanting completed. |
| | Kuala Selangor | 18,564 | ... | ... | ... | ... | Tanjong Karong and Sekenchau—694 acres—abandoned. Preparation of land in progress in other mukims except Jeram where transplanting is in hand. Delay was due to dry weather. |
| | | 23,236 | ... | ... | ... | ... | |
| Straits Settlements | Malacca, Central | 16,473 | ... | ... | ... | ... | Planting almost completed. |
| | Alor Gajah | 11,136 | ... | ... | ... | ... | Planting almost completed. |
| | Jasin | 5,756 | ... | ... | ... | ... | Preparation of land and transplanting commenced. |
| | | 33,365 | ... | ... | ... | ... | |
| „ | P. Wellesley, North | 18,560 | ... | ... | ... | ... | Very little progress made owing to lack of water. |
| | Central | 10,539 | ... | ... | ... | ... | Clearing in progress. Nurseries have been prepared and sown. |
| | South | 4,649 | ... | ... | ... | ... | Clearing in progress. Few nurseries have been prepared and sown. |
| | | 33,748 | ... | ... | ... | ... | |
| | Penang | 4,000 | ... | ... | ... | ... | Clearing almost completed. |
| | Singapore | nil | ... | ... | ... | ... | |

N.B.—The figures given in the latest return under column 3 may be accepted as more accurate than any given in previous returns.

# METEOROLOGICAL SUMMARY, MALAYA. AUGUST, 1930.

| Locality | Air Temperature in Degrees Fahrenheit: Means of A. Max. | Means of B. Min. | Mean of A and B | Absolute Extremes: Highest Max. | Lowest Min. | Lowest Max. | Highest Min. | Earth Temperature: At 1 foot | At 4 feet | Rainfall: Total | Total | Most in a day: Amt. | Number of days: Precipitation* | Precipitation, 1mm. or more | Thunder-storm | Thunder heard | Fog morning obs. | Gale force 8 or more | Bright Sunshine: Total | Daily Mean | Per cent | Length of Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | °F | °F | °F | °F | °F | °F | °F | in. | mm. | in. | | | | | | | hr. | hr. | % | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 92.7 | 71.3 | 82.0 | 98 | 69 | 88 | 74 | 83.3 | 83.8 | 6.06 | 153.9 | 1.98 | 16 | 10 | 2 | 11 | 2 | | 230.50 | 7.43 | 61 | 12.2 |
| Bukit Jeram, Selangor ... | 90.1 | 72.9 | 81.5 | 93 | 69 | 87 | 76 | 86.1 | 88.3 | 3.21 | 81.5 | 0.99 | 14 | 11 | 2 | 13 | 16 | | 246.10 | 7.94 | 65 | 12.2 |
| Sitiawan, Perak ... | 90.1 | 71.8 | 80.9 | 95 | 69 | 80 | 75 | 84.4 | 84.7 | 3.22 | 81.8 | 0.93 | 10 | 8 | 7 | 18 | 2 | | 212.90 | 6.87 | ... | ... |
| Kroh, Perak ... | 86.7 | 69.4 | 78.1 | 92 | 66 | 79 | 72 | 81.4 | 83.1 | 6.21 | 157.7 | 1.09 | 17 | 16 | ... | 15 | ... | | 193.75 | 6.25 | ... | ... |
| Temerloh, Pahang ... | 92.2 | 71.9 | 82.1 | 96 | 68 | 86 | 74 | 86.2 | 86.6 | 3.62 | 91.96 | 1.06 | 11 | 10 | 3 | 20 | 4 | | 250.30 | 8.07 | 66 | 12.3 |
| Kuala Lipis, Pahang ... | 90.3 | 71.2 | 80.7 | 93 | 68 | 87 | 75 | 84.3 | 84.4 | 6.17 | 156.7 | 1.59 | 13 | 11 | 14 | 20 | 15 | | 221.55 | 7.15 | ... | ... |
| Kuala Pahang, Pahang ... | 87.4 | 74.6 | 81.0 | 90 | 71 | 85 | 78 | 88.4 | 87.9 | 2.18 | 55.4 | 0.99 | 7 | 5 | 7 | 15 | ... | | 283.45 | 9.14 | 75 | 12.2 |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 72.3 | 59.6 | 65.9 | 78 | 58 | 67 | 62 | ... | ... | 4.54 | 115.3 | 0.87 | 20 | 16 | 5 | 24 | 3 | | 174.25 | 5.62 | 46 | 12.3 |
| Cameron's Highlands, Tanah Rata | 72.8 | 53.7 | 63.3 | 77 | 48 | 68 | 60 | 69.7 | 69.6 | 3.66 | 92.9 | 0.68 | 19 | 17 | 5 | 24 | 11 | | 173.80 | 5.61 | 46 | 12.3 |
| Fraser's Hill, Pahang ... | 74.4 | 62.0 | 68.2 | 78 | 60 | 71 | 65 | 71.1 | 71.3 | 7.73 | 196.3 | 1.56 | 18 | 15 | 1 | 16 | 22 | | 213.15 | 6.88 | 56 | 12.2 |
| Mount Faber, Singapore ... | 89.9 | 77.3 | 83.6 | 92 | 72 | 85 | 80 | 84.4 | 85.4 | 1.80 | 45.7 | 0.56 | 9 | 6 | 1 | 11 | ... | | 279.05 | 9.00 | 74 | 12.2 |
| Butterworth, Province Wellesley | 88.1 | 73.8 | 80.9 | 92 | 71 | 83 | 77 | 86.5 | 85.4 | 3.77 | 95.77 | 1.00 | 15 | 12 | 1 | 19 | 1 | | 208.00 | 6.71 | ... | ... |
| Bukit China, Malacca ... | 85.5 | 73.2 | 79.3 | 88 | 70 | 81 | 76 | 84.6 | 85.3 | 3.95 | 100.3 | 1.21 | 14 | 11 | 3 | 5 | ... | | 265.40 | 8.56 | 70 | 12.2 |
| Kluang, Johore ... | 89.7 | 70.5 | 80.1 | 93 | 68 | 84 | 75 | 82.1 | 82.6 | 2.98 | 75.7 | 1.31 | 12 | 9 | 1 | 12 | 5 | | 231.70 | 7.47 | 61 | 12.2 |
| Bukit Lalang, Mersing, Johore... | 89.9 | 72.1 | 81.0 | 92 | 69 | 88 | 75 | 82.8 | 82.4 | 1.73 | 43.95 | 0.68 | 7 | 5 | ... | 18 | ... | 1 | 280.10 | 9.04 | 74 | 12.2 |
| Alor Star, Kedah ... | 88.6 | 73.8 | 81.0 | 92 | 71 | 84 | 77 | 86.7 | 86.8 | 9.34 | 237.24 | 4.64 | 19 | 12 | ... | 5 | ... | | 211.45 | 6.82 | ... | ... |
| Kota Bharu, Kelantan ... | 89.2 | 73.5 | 81.3 | 92 | 72 | 79 | 77 | 85.6 | 85.5 | 3.03 | 77.0 | 0.81 | 15 | 10 | 3 | 16 | ... | | 226.20 | 7.30 | ... | ... |
| Kuala Trengganu, Trengganu... | 88.5 | 72.7 | 80.6 | 92 | 69 | 77 | 76 | 83.2 | 83.9 | 12.85 | 326.4 | 4.93 | 10 | 9 | 2 | 8 | 2 | | 242.50 | 7.82 | ... | ... |

Precipitation ·01 inch or more when measurement is in inches ·2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

# Malayan Agricultural Journal.

Vol. XVIII. NOVEMBER, 1930. No. 11.

## Committees of the Department.

**The Advisory Committee.**

The Director of Agriculture (Chairman).
The Director, Rubber Research Institute.
The Director of Co-operation.
Mr. O. T. Dussek, representing the Education Department.
Yang Teramat Mulia Raja Abdul Aziz, C.M.G., Raja Muda of Perak
The Hon'ble Mr. Egmont Hake, M.F.C.
Mr. Lai Tet Loke.
Mr. J. Melville.
Mr. M. J. Kennaway.
Mr. W. A. Stanton.
Mr. G. S. Reis, B SC. (Agric.)
Mr. W. N C. Belgrave, (Secretary).

**Agricultural Pests Supervising Committee.**

(Under Sec 4 of Agricultural Pests Enactment 1913).
The Director of Agriculture (Chairman)
The Hon'ble the Legal Adviser
Mr. F. H. Mustard
B. J. Eaton, O.B E.

**The Departmental Technical Committee.**

The Director of Agriculture (Chairman)
The Heads of Divisions.
Mr. F S Ward (Secretary).

**The Malayan Agricultural Journal.**

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Editorial Committee for Department Publications—
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The Assistant to the Director.
The Chief Field Officer.
The Director, Rubber Research Institute of Malaya
The Editor, Malayan Agricultural Journal (Secretary).

**Coconut & Oil Palm Research Committee.**

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The Mycologist
The Agriculturist.
The Economic Botanist.
The Plant Physiologist.
The Agricultural Economist.
The Agricultural Chemist.
The Entomologist.
The Chief Agricultural Field Officer.
The Assistant Chemist for Copra Investigations (Secretary).

Delegates of the Second Inter-Departmental Agricultural Conference, Kuala Lumpur, October 27th to November 1st, 1930.

THE

# Malayan Agricultural Journal

NOVEMBER, 1930.

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## EDITORIAL.

**The Agricultural Conference, 1930.** The Second Inter-Departmental Agricultural Conference was held at Kuala Lumpur from 27th October to 1st November inclusive. The event provided a unique opportunity for the exchange of ideas between the officers of the Department of Agriculture, the Rubber Research Institute of Malaya, the Co-operative Department and the Veterinary Department.

It is perhaps early to venture a survey of the result of the Conference; the large number of subjects discussed and the diversity of angles from which each subject was reviewed by the departments, renders further consideration desirable. The resolutions passed and the numerous suggestions for future work will be considered by the appropriate officers in the coming months and eventually translated into action.

Such interchange of views between departments having much in common is of great value. The recent Conference cannot but lead to greater liaison between the departments concerned, which will necessarily result in greater efficiency and more effective service to the public.

The account of the Conference included in this number is necessarily brief, but it may enable the reader to realise the diversity of the subjects considered and of the value of the discussions to those whose duty it is to investigate such agricultural problems and to ensure the practical application of the result of research work of this nature. The publication in subsequent numbers of this Journal of certain of the conference papers will supplement the present account and will, it is thought, prove of value to planters in Malaya.

**Technical Reports for 1929.** The diffuse duties of an efficiently equipped department of agriculture make the preparation of an annual report of the head of department one of some difficulty. The writer of such a report can but give an outline of the activities within his department and is thus apt to do less than justice to the work of his officers. In so doing he is almost certain to omit much detailed information of value to the country served by his department. Completed research work is usually adequately described in the form of special articles and reports published from

time to time and in one form or another; but even when this is accomplished there remains much information of a miscellaneous nature which is lost to the public if it is not included in an annual report.

Hitherto, the system in this Department has been to publish the collected Annual Reports of Heads of Divisions in a number of *The Malayan Agricultural Journal.* The reorganised form of this Journal, however, renders such a course undesirable as it would interfere with the continuity of the present features of the Journal and would thereby delay the publication of other important articles. The system has, therefore, been adopted of publishing the Annual Reports of Technical Officers in the form of a Special Bulletin. These reports in respect of the year 1929 will be in the hands of subscribers in this form during the present month.

The work of the Department of Agriculture, S.S. & F.M.S. is divided into that performed by the technical staff, stationed as a rule at headquarters in Kuala Lumpur, and that of the field staff, stationed throughout the country. This latter staff, under the supervision of a Chief Agricultural Field Officer stationed at headquarters, is mainly engaged in the application of the results obtained by the technical officers to the conditions peculiar to the territory served by each. These duties are generally designated as the Extensional Services.

In the past, it has been the practice to condense the annual reports of the field officers in the form of the report of the Chief Agricultural Field Officer. This officer experiences the same difficulty in presenting an adequate account of the activities of his Division as are experienced by the Director in preparing a report on the work of the Department. In order, therefore, that the field work may be presented to the public in sufficient detail, the annual reports of the field staff will also be published as a Special Bulletin. This publication, in respect of the year 1929, is already in the press and it is hoped, will be distributed before the end of this year.

These two publications are recommended to the public with the assurance that they render an adequate account of the work of the Department and make it possible for the reader to obtain an intimate and valuable insight into the progress of the agriculture of Malaya.

**Rainfall.** With the exception of padi, the major crops of Malaya demand a heavy annual rainfall fairly well distributed throughout the year. The success of rubber, coconuts, oil palms and pineapples, for instance, is very largely accounted by this even precipitation. Padi and most annual crops are grown more successfully in situations where the seasons are more defined. Although Malaya experiences dry spells, it is difficult to predict the months in which they will occur in any year. In view of the desirability of improving our present areas under padi—a matter largely connected with water supply—and of developing new areas, in addition to the increased attention given to the development of new agricultural industries, a more exact knowledge of rainfall is essential.

Rainfall and other meteorological data has been recorded at various stations in Malaya for many years past and are published in *The Malayan Agricultural Journal* and elsewhere, but no serious attempt appears to have been made, hitherto, to analyse the data so obtained in order that agriculturists may know to what extent seasons exist and what the climatic variations are in different parts of the country. At our request, Mr. Stewart, Superintendent of the Meteorological Branch, Malaya, has prepared an article which is included in the present number, from which we can envisage the climatic variations throughout Malaya. The article merits more than passing attention because it has a direct bearing on the crops grown in the country, and also because it should enable the planter to organise his work of cultivation, planting and draining in closer conformity with the weather conditions throughout the year.

**Advertising.** The pages of advertisements which appear monthly in this Journal are not designed merely to provide revenue for the Journal, but to bring before readers the range of agricultural equipment which is at their command. With this object in view, an endeavour has been made to confine advertisements to those of an agricultural nature. Furthermore, advertisers are encouraged to change their advertisements at frequent intervals so that the scope and interest of these pages are increased to the reader. While this policy is against the financial interests of the Journal, we believe it can be made to pay because readers will thereby make a habit of reading the advertisements as methodically as they read other matter in the Journal.

Technical periodicals are frequently purchased—not mainly for the articles they contain—but because the reader finds it necessary to keep himself well informed of improvements effected on the equipment side of his profession. Advertisements are frequently the only form of shop window possessed by manufacturers and dealers in such goods as agricultural machinery, fertilisers, insecticides and fungicides, and it is for this reason that we hope that our readers may benefit by the advertisements contained in *The Malayan Agricultural Journal.*

Advertisers frequently find it difficult to gauge the effectiveness of their advertisements. Readers will therefore render a service to both the advertisers and the Journal if, in replying to advertisements, they mention the periodical which induced their enquiry.

# Original Articles.

## THE RAINFALL OF MALAYA

BY

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In equatorial regions the annual variation of temperature is insignificant and any division of the year into seasons is based on the relative amounts of rainfall experienced at different times of the year. Wet and dry seasons take the place of cold and hot seasons and the variation of rainfall throughout the year comes to have an importance similar to that which temperature variation has in middle latitudes.

The significance of the terms "wet" and "dry", as applied to seasons in Malaya is, however, entirely relative. There is no part of the year, in any district, in which excessive rainfall may not be experienced; and similarly, there is no part of the year in which, for a time at least, rainfall may not be slight. The seasonal characteristics give the normal experience and also express very strong probabilities. Moreover, the average monthly rainfall for almost any Malayan station in its "dry" season would be regarded as a considerable amount of precipitation at any station in temperate latitudes. The driest month at Singapore, for example, is May, with an average rainfall of 6.65 inches.

The type of seasonal variation of rainfall in the Malay Peninsula is not uniform over the country. The characteristic variation of the East Coast is totally different from that of the West Coast and the interior. One part of the West Coast, again, has a seasonal variation which is peculiar to itself, while the characteristics of the inland variation extend everywhere else to the West Coast. There are thus three distinct regions each with its characteristic seasonal variation. The first region is along the East Coast and probably extends inland for twenty miles or so; such observations as are available show that this type of variation is very rapidly replaced as we leave the East Coast by the type of the inland region, which includes the whole of the Peninsula with the exception of the East Coast, and the previously mentioned portion of the West Coast. This last named stretch of coast, with a narrow strip of land behind it, forms the third region.

The differences in the regional characteristics, and in fact, the seasonal variations themselves, are due to the changes in the main wind currents flowing over the Peninsula. A strong north-easterly wind commences late in October or during November and continues until some time in March, and is known as the North East Monsoon, although it seems probable that it is due to a southerly movement of the north-east trade wind of the China Sea rather than to what is usually understood as a monsoon effect. From May to August a light

south-westerly wind blows. This wind is not strong and at the surface is entirely subordinate to the fresh land and sea breezes which are experienced by night and day respectively; nevertheless, in the upper air the general drift is from the south-west. This again is known, though perhaps not so generally, as the South-West Monsoon. This current, however, does not blow across the whole length of the Peninsula like the North-East Monsoon, but only extends southward to the region of Malacca on the West Coast and to Pekan on the East Coast. South of this the prevailing direction is South East, the air-stream arriving from south of the Equator. The interval between the cessation of the North East Monsoon and the commencement of the South West Monsoon varies in length by a few days but is usually about eight weeks and there is a similar interval between the end of the South West Monsoon and the beginning of the North East Monsoon. These transition intervals are long enough to be regarded as "seasons", so that the Malayan year is divided more or less naturally into four seasons, namely, the North East Monsoon, the South West Monsoon and the shorter seasons separating the monsoons, when there is no real prevailing wind current but a more or less stagnant atmosphere. The rainfall does not everywhere show a seasonal variation corresponding to the seasons as specified in this way by their wind characteristics, but over the greater part of the Peninsula, including the whole of the interior, there is a well defined variation with two maxima and two minima whose times closely follow those of these wind seasons.

The three principal "regions" have already been defined above. In the East Coast region the rainfall follows the North East Monsoon, reaching its maximum intensity about the middle of the monsoon, in December, and its minimum in July. There is some evidence that the actual times of maxima and minima become slightly later as we go south from Kota Bharu, but this change is not sufficiently large to show itself with any clearness in the monthly totals. The broad seasonal variation shows in the monthly totals as this single oscillation without any secondary maxima or minima.

In the West Coast region, over a short length of coast about Malacca, the variation is exactly the reverse, the maximum intensity being experienced about August and the driest month being January. In this case the main variation consists of a single oscillation in twelve months, the maximum and minimum occurring as stated. The decrease of rainfall from August to January is, however, interrupted to some extent by a slight but definite increase for October, which corresponds with a very decided maximum at this time at all inland stations. The length of coast along which this type of annual variation is experienced appears to be limited. At Port Dickson and Malacca it is very well defined but further south at Batu Pahat and Kukub it disappears and we find the variation common to the interior and the northern part of the West Coast, to be described below. The observations available for this part of the coast are somewhat restricted, both with regard to the number of stations and to the number of years for which observations exist, but it seems reasonably

clear that the Johore coast does not experience the same seasonal rain as Malacca. It will be understood from this that by "West Coast variation" is meant a variation which is experienced only on the West Coast, but not one which is typical of the West Coast. This particular type of variation, also its limited extent, can probably be explained by the fact that it is in this area that the south westerly winds of the northern half of the Peninsula meet the south-easterly winds of the southern half. In the middle of the year, when this takes place, the south easterly current is distinctly warmer than the south westerly one as is shown by the air temperatures at Singapore being, on the average, about 3°F. higher than those at Malacca at this time of year. The warmer, and consequently lighter, air rises over the denser south westerly current and thus produces the rainfall experienced at this season.

The third region, comprising the whole of the interior and the northern and southern parts of the West Coast, has a seasonal variation in which the middle of the North East Monsoon and the middle of the South West Monsoon are times of comparatively low rainfall while the transition seasons between the monsoons are both wet periods. The curve of rainfall for the year thus shows two maxima, about April and October, and two minima, about January and July. The times of maxima and minima vary to some extent from place to place, but the variations do not follow any simple law and only appear clearly in a harmonic analysis of the seasonal changes of rainfall. It is of interest to note that Singapore belongs quite definitely to the East Coast region with regard to rainfall though the seasonal variation is itself comparatively small.

The summary of Malayan rainfall conditions outlined in the preceding paragraphs has dealt only with the general character of the seasonal changes which are experienced in different areas and not at all with the actual distribution of rainfall. In the actual quantities of rain measured there are wide variations, even over relatively short distances, and between stations at which the seasonal changes are similar in type. It is necessary, therefore, in order to complete such an account, to give a reasonably comprehensive table of the rainfalls measured at different stations. The data available are by no means uniform, either in the distribution of stations or in the number of years for which records are available. In Perak, for example, there are many more stations than those shown on the map and only a fairly representative selection has been included; Kelantan and Trengganu, on the other hand, each have only one station with any useful series of records. The Trengganu records, further, only include five years' observations and would not be quoted in any paper such as the present one but for their being the only ones available; whereas in Perak no station included here has less than 20 years' observations and many have been observing for more than 40 years. In Pahang, again, the data available are exiguous although such stations as do exist have records extending, for the most part, over a considerable number of years. That such extensive areas should be without any adequate rainfall records is largely due to the undeveloped nature of much of the country, covered as it is with primitive jungle.

TABLE I.

AVERAGE MONTHLY RAINFALL AT EAST COAST STATIONS.

| STATIONS. | | MONTHLY RAINFALL TOTALS. | | | | | | | | | | | | | Seasonal percentages of annual rainfall. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of years. | Jan. | Feb. | Mar. | Apl. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Year. | Nov. to Feb. | Mar. Apl. Sept. Oct. | May to Aug. |
| | | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | % | % | % |
| 7. Kota Bharu ... | 23 | 10.29 | 6.66 | 6.99 | **4.51** | 6.17 | 6.40 | 5.59 | **6.74** | 8.64 | 11.47 | 22.95 | **27.49** | 123.90 | 54 | 26 | 19 |
| 8. Kuala Trengganu ... | 5 | **9.22** | 12.75 | **16.81** | 6.11 | 5.49 | 5.23 | **3.22** | 4.07 | 6.88 | 16.68 | **34.31** | 28.54 | 149.31 | 57 | 31 | 12 |
| 26. Kuantan ... | 33 | 15.22 | 9.05 | 8.35 | 6.28 | 6.62 | **5.61** | 5.64 | 6.22 | 7.78 | 10.83 | 13.46 | **23.41** | 118.47 | 51 | 28 | 21 |
| 25. Pekan ... | 35 | 16.32 | 12.39 | 8.72 | 6.81 | 6.45 | 5.19 | **4.42** | 6.66 | 6.93 | 10.69 | 16.70 | **28.45** | 129.73 | 56 | 27 | 17 |
| 29. Rompin ... | 13 | 23.68 | 14.39 | 11.45 | 6.13 | **5.54** | 5.70 | 5.58 | 7.05 | 6.87 | 8.59 | 16.32 | **26.74** | 138.04 | 59 | 24 | 17 |
| 50. Mersing ... | 11 | 16.94 | 9.07 | 7.26 | **5.08** | 6.31 | 6.11 | 6.26 | **7.46** | 5.80 | 8.36 | 12.64 | **20.99** | 112.28 | 54 | 24 | 22 |
| 51. Singapore ... | 52 | 9.88 | **6.62** | 7.40 | 7.64 | 6.65 | 6.85 | **6.77** | 7.95 | 6.77 | 8.07 | 9.92 | **10.55** | 95.07 | 41 | 30 | 29 |

A reference map is given from which the individual stations can be identified by their numbers. The number of years for which observations are available is shown for each station in the second column of the tables. Maximum and minimum monthly rainfalls, both principal and secondary, are printed in heavy type, in order to show clearly the type of seasonal variation for each station. The data for the 51 stations are brought together in three tables as it is natural and convenient to consider separately the stations of the East Coast, those of the West Coast and those of the interior.

In Table I the typical East Coast variation appears clearly at all stations except Kuala Trengganu. Ignoring this station for the moment, the heaviest month's rainfall is found everywhere in December. The minimum occurs in different months being earliest in the extreme north and latest at the intermediate stations. The magnitude of the variation is of some interest. While in Singapore the wettest month has less than twice the rain of the driest (if we may use this adjective) at Pekan the maximum month's rainfall is more than six times the minimum. Of this group of stations, Singapore has the lowest wet season rainfall and the highest dry season rainfall. In considering seasonal variations of this type, where the figures represent mean monthly totals, as distinct from mean daily values, it is necessary to bear in mind that for comparison the February figures require to be increased by 11 per cent. on account of the extra three days in January and March. The Kuala Trengganu seasons appear to show the characteristics of the inland rainfall rather than those of the East Coast. It is difficult to be certain about a point of this nature with only five years' records, especially when an abnormal monsoon rainfall such as 1926—1927 is included, but the figures are so regular that it is almost more difficult not to accept the succession of values as being representative, whatever the absolute totals may eventually prove to be. But that Kuala Trengganu, in spite of this apparent divergence from the general East Coast characteristics, has the same main seasons, appears clearly from the last three columns, in which are given for each station the percentages of the years' rainfall which are experienced during the season of the North East Monsoon, the season of the South West Monsoon and the two transition periods combined. The division into three periods of equal length naturally gives only an approximation to the true seasonal periods but this does not affect the comparison.

From the right section of Table I it appears that at Kuala Trengganu, as at the other East Coast stations with the exception of Singapore, considerably more than half the year's rainfall falls between the beginning of November and the end of February and from one-fifth to one-tenth between the beginning of May and the end of August. In the case of Singapore the general features are the same but the variation is much smaller in extent, the difference between the maximum and minimum rainfalls being comparatively small.

The annual rainfall along the East Coast is everywhere relatively heavy with the exception of Singapore. The Kuala Trengganu totals cannot be taken as representative as the five years' records which are available include at least

# TABLE II.

## Average Monthly Rainfall at West Coast Stations.

| STATIONS. | No. of years | Jan. | Feb. | Mar. | Apl. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Year. | Nov. to Feb. | May June July Aug. | May to Aug. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MONTHLY RAINFALL TOTALS | | | | | | | | | | | | | Seasonal percentages of annual rainfall. | | |
| | | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | % | % | % |
| 1. Pulau Langkawi ... | 13 | **1.39** | 1.72 | 5.31 | 7.32 | **10.24** | **7.93** | 8.55 | 11.19 | 12.19 | **13.65** | 7.48 | 3.71 | 90.68 | 16 | 42 | 42 |
| 2. Perlis ... | 21 | **1.77** | 2.08 | **5.47** | 7.22 | **8.67** | **6.65** | **8.34** | **8.60** | **11.09** | 10.53 | 8.29 | 4.13 | 82.84 | 20 | 41 | 3[illegible] |
| 3. Alor Star ... | 23 | 2.47 | **2.08** | 5.93 | 8.73 | **11.09** | **7.83** | 7.88 | 10.81 | **13.45** | 11.70 | 7.98 | 5.79 | 95.74 | 19 | 42 | 39 |
| 4. Sungei Patani ... | 17 | 3.64 | **2.96** | 5.91 | **9.17** | 9.00 | **4.79** | 6.69 | 7.55 | 12.29 | **15.71** | 10.82 | 5.35 | 93.88 | 24 | 46 | 30 |
| 13. Penang ... | 39 | 3.82 | **2.91** | 4.96 | 6.93 | **10.79** | **7.68** | 8.35 | 12.84 | 16.14 | **16.61** | 11.81 | 4.96 | 107.53 | 22 | 41 | 37 |
| 12. Parit Buntar ... | 42 | 5.26 | **4.33** | 7.56 | **8.86** | 6.95 | 5.09 | **5.08** | 6.93 | 9.50 | **11.58** | 10.65 | 6.90 | 88.69 | 31 | 42 | 27 |
| 21. Pangkor ... | 26 | 9.32 | 6.93 | **6.85** | **7.34** | 6.64 | 4.99 | **4.98** | 5.26 | 9.48 | 12.85 | **13.03** | 10.87 | 98.53 | 41 | 37 | 22 |
| 20. Bagan Datoh ... | 12 | 8.21 | **6.17** | 6.43 | **7.31** | 5.03 | **3.16** | 3.24 | 4.75 | 7.82 | 9.02 | **10.64** | 8.26 | 80.04 | 42 | 38 | 20 |
| 31. Kuala Selangor ... | 43 | 7.31 | **4.39** | 4.82 | **5.78** | 4.96 | 3.76 | **3.67** | 4.55 | 5.71 | 9.03 | **9.33** | 9.01 | 72.32 | 41 | 35 | 23 |
| 32. Klang ... | 43 | 7.97 | **5.96** | 7.08 | **8.58** | 6.50 | 4.49 | **4.46** | 5.76 | 6.10 | 9.40 | **10.25** | 10.15 | 86.70 | 40 | 36 | 24 |
| 35. Kuala Langat ... | 42 | 7.49 | **4.46** | 4.66 | **6.98** | 5.60 | **5.15** | 5.56 | 6.44 | 7.39 | 9.28 | **10.90** | 10.33 | 84.24 | 39 | 34 | 27 |
| 39. Port Dickson ... | 30 | 4.88 | **3.76** | **4.44** | 8.09 | 6.60 | 7.12 | **7.71** | 10.02 | 9.09 | **11.32** | 9.84 | 7.88 | 90.75 | 29 | 25 | 36 |
| 41. Malacca ... | 35 | **3.23** | 3.51 | 4.41 | 6.85 | 6.58 | 7.76 | 8.23 | **10.71** | 8.35 | 9.77 | 8.31 | 6.18 | 83.89 | 25 | 34 | 41 |
| 44. Muar ... | 13 | 6.41 | **3.79** | 6.43 | **8.37** | 7.14 | 7.01 | **6.56** | 7.55 | **9.20** | 8.27 | 8.16 | 5.49 | 84.38 | 31 | 38 | 31 |
| 45. Batu Pahat ... | 14 | 8.40 | **6.15** | 8.47 | **8.51** | 6.65 | 6.64 | **6.27** | 8.15 | 8.69 | **9.24** | 8.63 | 5.67 | 91.47 | 31 | 38 | 31 |
| 47. Kukub ... | 8 | 10.35 | **7.79** | **10.26** | 9.26 | 7.35 | 8.23 | **6.31** | 8.71 | 9.73 | **13.97** | 8.88 | 8.59 | 109.43 | 32 | 39 | 29 |

one exceptionally wet year and an extension of the term of years will almost certainly reduce the average values to a considerable extent. The centre of heaviest rainfall is probably in the neighbourhood of Rompin with a slight diminution as we go north from there and a decided diminution as we go south. The average annual rainfall in this region may be taken to be about 120 inches.

Table II gives the available data for the West Coast. The double variation during the year appears to a varying extent at all stations except Malacca. Port Dickson is classed with Malacca in this table as, although it shows two maxima and two minima, the principal variation is a single one similar in the main to the Malacca one. These are the only two stations to show this peculiarity and in the case of Port Dickson the maximum and minimum are later than at Malacca. It may be noted here that over the greater part of the Peninsula the effect of the North East Monsoon is very great, even where a maximum rainfall would appear to go with the seasons between the monsoons. In a number of cases the maximum appears in November rather than in September or October. The stations where this occurs are all along the limited stretch of coast between Pangkor and Kuala Langat, that is to say along the southern part of the coast of Perak and the coast of Selangor. At these stations, the seasonal percentages given in the last three columns of the table show that the North East Monsoon season has the greatest proportion of the year's rainfall and the South West Monsoon season the lowest. At other stations, apart from the two stations in the Malacca section, where the South West Monsoon season is the wettest, we find that the transition seasons have the greatest proportional rainfall.

The West Coast may thus be conveniently divided into four sections. The southernmost section is, on the whole, similar to the northern section but the seasonal proportions are somewhat different. It is worthy of note that in each section, in spite of the considerable variations of total rainfall from station to station, the seasonal proportions show very close agreement.

The monthly rainfall averages for inland stations given in Table III are noteworthy for the regularity with which the seasonal variation appears. Of the 28 stations shown, only two are without a July minimum. These two have minima in June that are very little lower than the July figures; in fact, if we allowed for the month of July being longer by one-twentieth than June the minimum would in each of these two cases appear in July as at every other station. The April maximum and the February minimum also appear very consistently. The minimum in October, however, is in many instances masked by the effect of the North East Monsoon. This is the case in South Perak and Negri Sembilan, where the maximum is in November and in South Pahang, where it appears in December and still more in South Johore, with maximum rainfall as late as January. It should be noted, however, that at all these stations a relatively heavy rainfall is attained by October, and at those stations where the maximum is reached in November there is generally very little excess over the October rainfall.

# TABLE III.

## Average Monthly Rainfall at Inland Stations.

| STATIONS. | No. of years | Jan. | Feb. | Mar. | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Year. | Nov. to Feb. | Mar. Apl. Sept. Oct | May to Aug. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MONTHLY RAINFALL TOTALS. | | | | | | | | | | | | | Seasonal percentages of annual rainfall. | | |
| | | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | % | % | % |
| 5. Baling ... | 15 | 3.20 | **2.80** | 7.28 | **9.62** | 7.41 | **5.00** | 5.08 | 6.04 | 8.87 | **13.15** | 9.78 | 4.76 | 82.99 | 25 | 47 | 28 |
| 6. Kulim ... | 21 | 6.88 | **5.87** | 11.61 | **14.09** | 10.07 | 6.32 | **6.24** | 8.05 | 11.06 | **17.66** | 16.36 | 10.06 | 124.27 | 31 | 44 | 25 |
| 9. Klian Intan ... | 17 | 3.45 | **2.89** | 6.53 | **8.87** | 8.54 | 5.72 | **5.41** | 6.68 | 9.58 | **13.72** | 9.97 | 7.55 | 88.91 | 27 | 43 | 30 |
| 10. Grik ... | 26 | 4.01 | **2.97** | 6.63 | 8.15 | **8.77** | **5.29** | 5.35 | 6.57 | 8.59 | **12.74** | 9.31 | 7.05 | 85.43 | 27 | 43 | 30 |
| 11. Selama ... | 39 | **9.02** | 9.31 | 13.32 | **17.93** | 12.71 | 7.50 | **7.09** | 9.70 | 13.24 | **19.23** | 17.73 | 11.77 | 148.55 | 37 | 38 | 25 |
| 14. Lenggong ... | 28 | 4.47 | **3.58** | 6.00 | **7.70** | 6.25 | 4.63 | **4.04** | 5.51 | 6.86 | **10.73** | 10.68 | 6.45 | 76.90 | 33 | 40 | 27 |
| 15. Taiping ... | 42 | 14.07 | **11.97** | 17.23 | **19.34** | 13.13 | 6.89 | **6.89** | 9.03 | 12.39 | **20.85** | 18.81 | 15.58 | 166.18 | 36 | 42 | 22 |
| 16. Kuala Kangsar ... | 42 | 5.61 | **4.95** | 7.25 | **8.41** | 5.99 | 3.96 | **3.64** | 5.33 | 7.42 | **10.86** | 10.76 | 7.07 | 81.25 | 35 | 42 | 23 |
| 17. Batu Gajah ... | 42 | 8.35 | **6.37** | 9.20 | **10.85** | 7.85 | 5.12 | **4.39** | 6.56 | 8.25 | 10.73 | **11.62** | 10.19 | 99.48 | 37 | 39 | 24 |
| 18. Tapah ... | 41 | 12.69 | **9.68** | 13.76 | **15.83** | 12.61 | 8.11 | **6.50** | 8.63 | 11.45 | 16.63 | **17.19** | 13.37 | 146.45 | 36 | 40 | 24 |
| 19. Teluk Anson ... | 42 | 9.79 | **7.25** | 9.04 | **9.74** | 6.91 | 4.69 | **3.92** | 5.31 | 7.09 | 11.45 | **11.81** | 11.29 | 98.29 | 41 | 38 | 21 |
| 22. Kuala Lipis ... | 33 | 9.11 | **5.35** | 6.22 | 8.37 | **8.92** | 7.64 | **5.24** | 7.25 | 8.44 | **12.02** | 11.28 | 11.51 | 101.35 | 37 | 34 | 29 |
| 23. Raub ... | 30 | 8.83 | **5.31** | 5.82 | **7.49** | 5.87 | 5.22 | **4.28** | 5.60 | 7.57 | 10.30 | **11.75** | 9.67 | 88.01 | 40 | 36 | 24 |
| 24. Bentong ... | 29 | 9.46 | **5.82** | 7.71 | **8.56** | 6.76 | 5.55 | **3.55** | 5.23 | 6.16 | 9.80 | 12.00 | **12.05** | 92.65 | 43 | 34 | 23 |
| 27. Sungei Lembing ... | 17 | 14.38 | **8.57** | 12.16 | 10.66 | **12.42** | 7.47 | **6.12** | 8.72 | 10.74 | 14.20 | 16.12 | **17.41** | 138.97 | 41 | 34 | 25 |
| 28. Temerloh ... | 30 | 7.83 | **3.85** | 6.03 | **7.57** | 6.62 | 4.28 | **3.42** | 5.61 | 6.52 | 9.27 | 9.70 | **10.08** | 80.78 | 39 | 36 | 25 |
| 30. Kuala Kubu ... | 36 | 7.77 | **5.45** | 9.26 | **11.90** | 10.12 | 7.47 | **6.36** | 8.11 | 9.83 | **16.15** | 13.24 | 10.31 | 115.97 | 32 | 40 | 28 |
| 33. Kuala Lumpur ... | 51 | 6.64 | **6.04** | 8.79 | 10.67 | 8.38 | 4.87 | **4.18** | 6.22 | 7.27 | **11.13** | 10.04 | 9.57 | 93.80 | 35 | 40 | 25 |
| 34. Kajang ... | 38 | **5.75** | 6.39 | 9.22 | **10.42** | 8.00 | 5.03 | **3.93** | 5.66 | 6.84 | **10.49** | 10.19 | 9.07 | 90.99 | 35 | 40 | 25 |
| 36. Jelebu ... | 39 | 4.72 | **3.43** | 6.40 | **6.54** | 5.54 | 3.75 | **3.18** | 3.89 | 4.52 | 7.19 | **8.15** | 7.37 | 64.68 | 37 | 38 | 25 |
| 37. Seremban ... | 43 | **5.28** | 5.31 | 8.44 | **10.36** | 7.68 | 5.84 | **4.85** | 6.26 | 7.42 | **10.26** | 9.47 | 8.60 | 89.77 | 32 | 41 | 27 |
| 38. Kuala Pilah ... | 33 | 6.81 | **4.65** | 6.97 | **7.57** | 5.60 | 4.72 | **3.55** | 4.17 | 4.78 | 8.08 | **8.73** | 8.55 | 74.18 | 39 | 37 | 24 |
| 40. Tampin ... | 27 | 4.94 | **4.12** | 6.38 | **8.21** | 6.54 | 5.48 | **5.15** | 6.36 | **6.31** | 8.58 | 8.93 | 7.24 | 78.24 | 32 | 38 | 30 |
| 42. Segamat ... | 14 | 12.16 | **5.29** | 7.44 | **7.56** | 5.73 | 5.04 | **4.35** | 4.84 | 6.04 | **8.88** | 8.80 | 7.79 | 83.92 | 41 | 35 | 24 |
| 43. Tangkak ... | 13 | 9.21 | **6.22** | 8.73 | **11.95** | 6.53 | 6.78 | **5.87** | 6.53 | 7.51 | **9.82** | 8.76 | 6.73 | 94.64 | 33 | 40 | 27 |
| 46. Kluang ... | 7 | **13.75** | **6.47** | 8.23 | **9.51** | 7.62 | 5.56 | **3.98** | 5.52 | 7.31 | 7.97 | 9.34 | 11.14 | 96.40 | 42 | 34 | 24 |
| 48. Johore Bahru ... | 14 | **14.00** | **8.71** | 10.98 | **11.17** | 8.91 | 6.79 | **6.18** | 7.91 | 10.11 | 8.40 | 11.04 | 9.70 | 113.90 | 38 | 35 | 27 |
| 49. Kota Tinggi ... | 12 | **18.95** | **6.14** | 8.85 | **10.68** | 10.09 | 10.48 | **6.30** | 8.28 | 9.02 | 11.62 | 12.70 | 13.02 | 126.11 | 40 | 32 | 28 |

The boundary between Perak and Pahang and Selangor and Pahang is a natural one formed by a mountain range generally more than 4,000 feet high and in many places 5,000 and 6,000 feet. The December maxima all appear at stations to the east of this range. In Johore where we find January maxima, there is no considerable mountain range and the seasonal variation here only departs in a minor degree from the typical East Coast variation.

The seasonal proportions of the annual rainfall, given in the last three columns of this table again give a useful summary of the district characteristics. The rainfall in the four months of the South West Monsoon (May to August), is at all stations low, being everywhere much below one-third of the year's total and in most cases only a quarter or less. The differences arise between the proportions occurring in the North East Monsoon season (November to February) and the four months forming the two intermediate seasons. In Pahang and Johore the larger proportion of the rain falls during the North East Monsoon whereas in all other districts it is the intermediate months which are the wettest. It may be noted that all these other districts lie to the west of the main mountain range.

The variations in rainfall from station to station, even in the same district, are sometimes very great. For example, Taiping has twice the annual rainfall of Kuala Kangsar. It is somewhat surprising to find, in these circumstances, that the seasonal division of the rainfall in these two places is practically identical. It will be seen that the districts separated in the table show within themselves fairly uniform seasonal characteristics, with only one or two exceptional stations in any district.

The stations whose rainfall observations have been quoted in the three tables given above are all low level stations. There are a few mountain stations in the Malay Peninsula but their records are better considered separately. The principal ones are given in Table IV. They are not shown on the station map but their positions are described in the text.

It is not necessary to make any detailed comments on the figures for the mountain stations. They are added principally to show what considerable differences can arise between places at comparatively short distances from one another, purely by reason of topographical peculiarities. Maxwell's Hill, for example, is about 4 miles east of Taiping, and "The Cottage" is about a mile further east again. These two stations have the heaviest rainfall recorded in Malaya.

Cameron's Highlands is on the border of Pahang and Perak a few miles south of the Kelantan border. Fraser's Hill lies practically at the point where the three states of Perak, Pahang and Selangor meet. These two stations have similar rainfalls, apparently not much greater in amount than at many of the low-level stations. The record period in each case is short and the figures given must not be regarded as established normals.

# TABLE IV.

## Average Monthly Rainfall at Mountains Stations.

| STATIONS. | No. of years | Height. | Jan. | Feb. | Mar. | A pl. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Year. | Seasonal percentages of annual rainfall. Nov. to Feb. | Mar. Apl. Sept. Oct. | May to Aug. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ft | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | Ins | % | % | % |
| Maxwell's Hill ... | 27 | 3400 | 12.88 | **9.61** | 14.95 | **20.07** | 18.33 | 13.19 | **9.25** | 15.58 | 19.36 | **26.30** | 24.53 | 17.31 | 201.36 | 30 | 44 | 26 |
| The Cottage ... | 26 | 4558 | 14.15 | **10.15** | 17.35 | 22.00 | **23.96** | 16.69 | **11.89** | 17.60 | 23.79 | **33.90** | 31.60 | 21.43 | 244.51 | 32 | 39 | 29 |
| Cameron's Highlands ... | .6 | 4750 | 7.86 | **5.34** | 8.50 | **13.82** | 9.46 | 5.93 | **4.18** | 5.57 | 12.72 | 11.93 | **14.57** | 11.08 | 110.96 | 35 | 42 | 23 |
| Fraser's Hill ... | 8 | 4286 | 13.91 | **6.78** | 11.09 | **11.78** | 6.94 | 4.77 | 3.57 | **3.28** | 8.03 | 11.04 | **15.39** | 13.99 | 110.57 | 45 | 38 | 17 |

At all these high level stations the double annual oscillation is very well defined. The greater exposure to the North East Monsoon in the case of Fraser's Hill and of Cameron's Highlands again throws the late maximum into November, but the first two stations give typical examples of the ordinary inland seasonal variation.

A brief description of the distribution of rainfall over the Peninsula at different seasons is necessary to complete the account of Malayan rainfall. A series of monthly maps would be the ideal manner of presenting this aspect of the subject, but the variation throughout any one season is sufficiently limited to make one typical map reasonably adequate for each season. The only maps included, therefore are those for December, representing the North East Monsoon; for July, representing the South West Monsoon and for March representing the intermediate seasons. There are differences from month to month within the seasons, but the charts given may be taken as fairly representative.

During the North East Monsoon there is very heavy rainfall along the East Coast, which gets rapidly less as we approach the West Coast. There is however, in Perak a strip of country near the coast where the rainfall in this season is much greater than further inland, but still only about half of that along the East Coast.

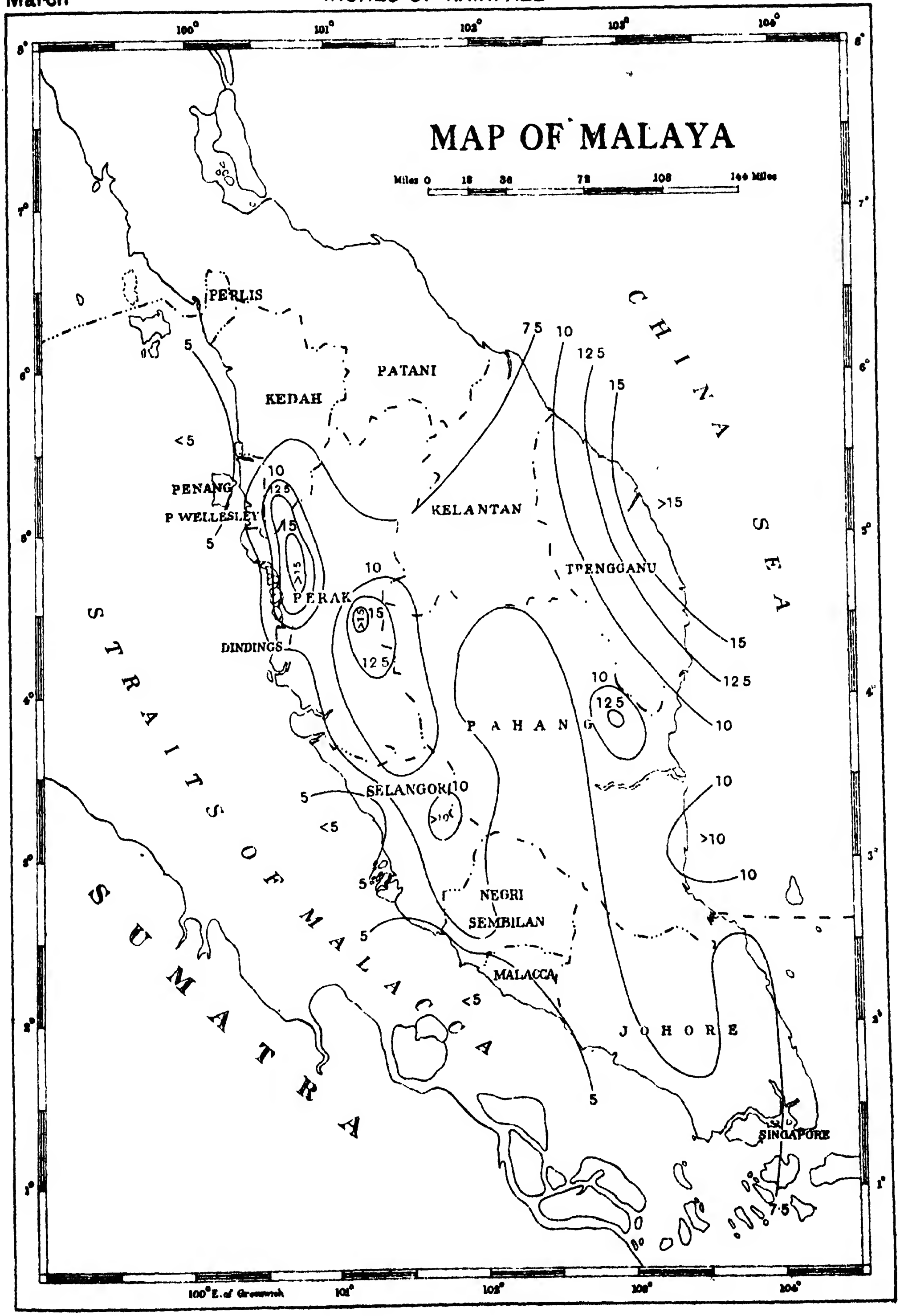
During the South West Monsoon the rain is everywhere comparatively light but with the greatest rainfall along the North West and South West portions of the coast. There are no great differences inland.

The transition seasons have moderately heavy rainfall everywhere, but speaking generally, there is again a long strip of country including Kedah, Perak and Selangor with very heavy rain. These features are, however, better seen from the charts than from any verbal description.

To complete this account of the rainfall of Malaya it would be necessary to give data with regard to the duration of rainfall, but unfortunately, the records available are too meagre for this to be done at present. Records are now being obtained at selected stations, although the material necessary for a proper discussion will not be available for some years.

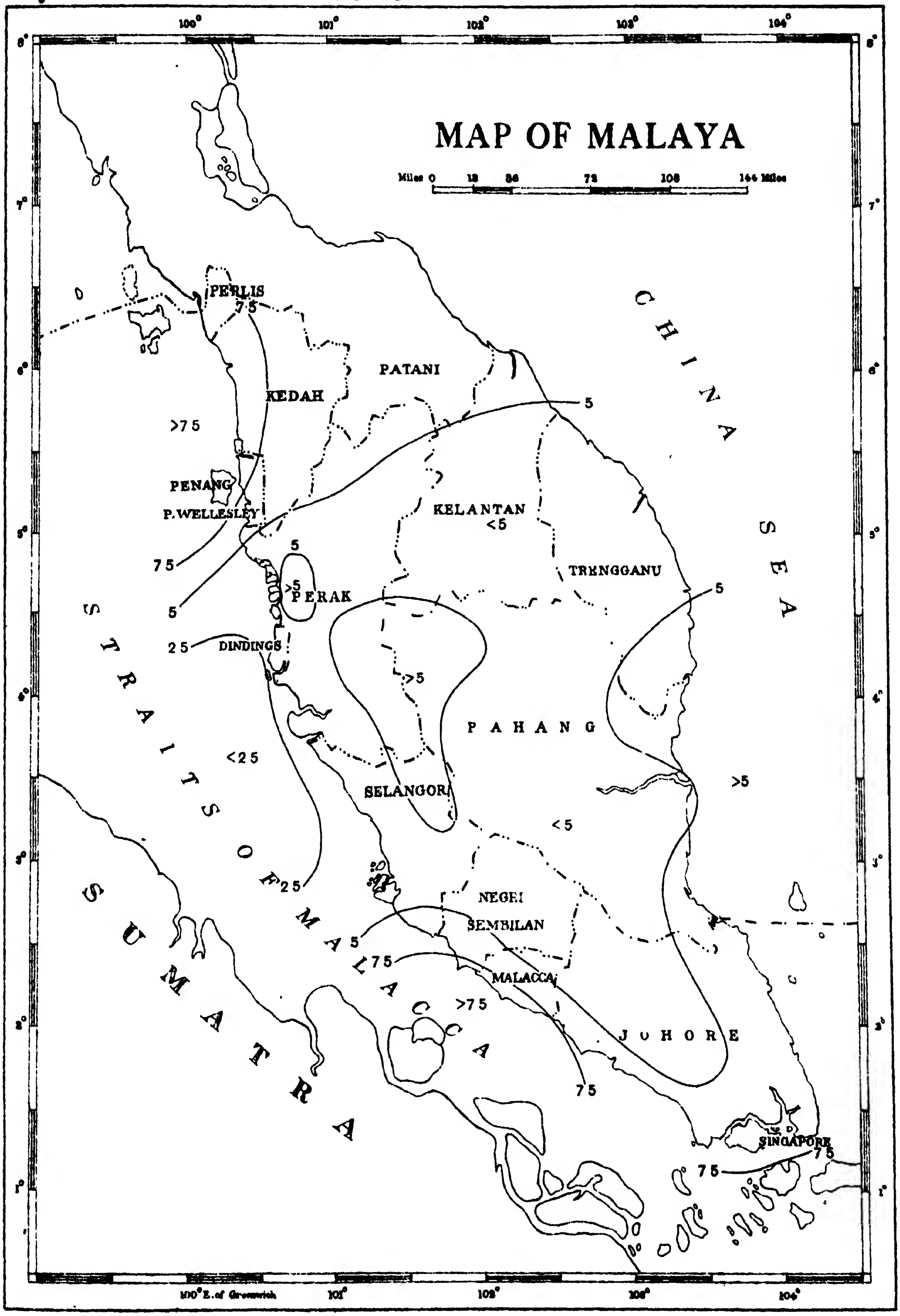
March

INCHES OF RAINFALL

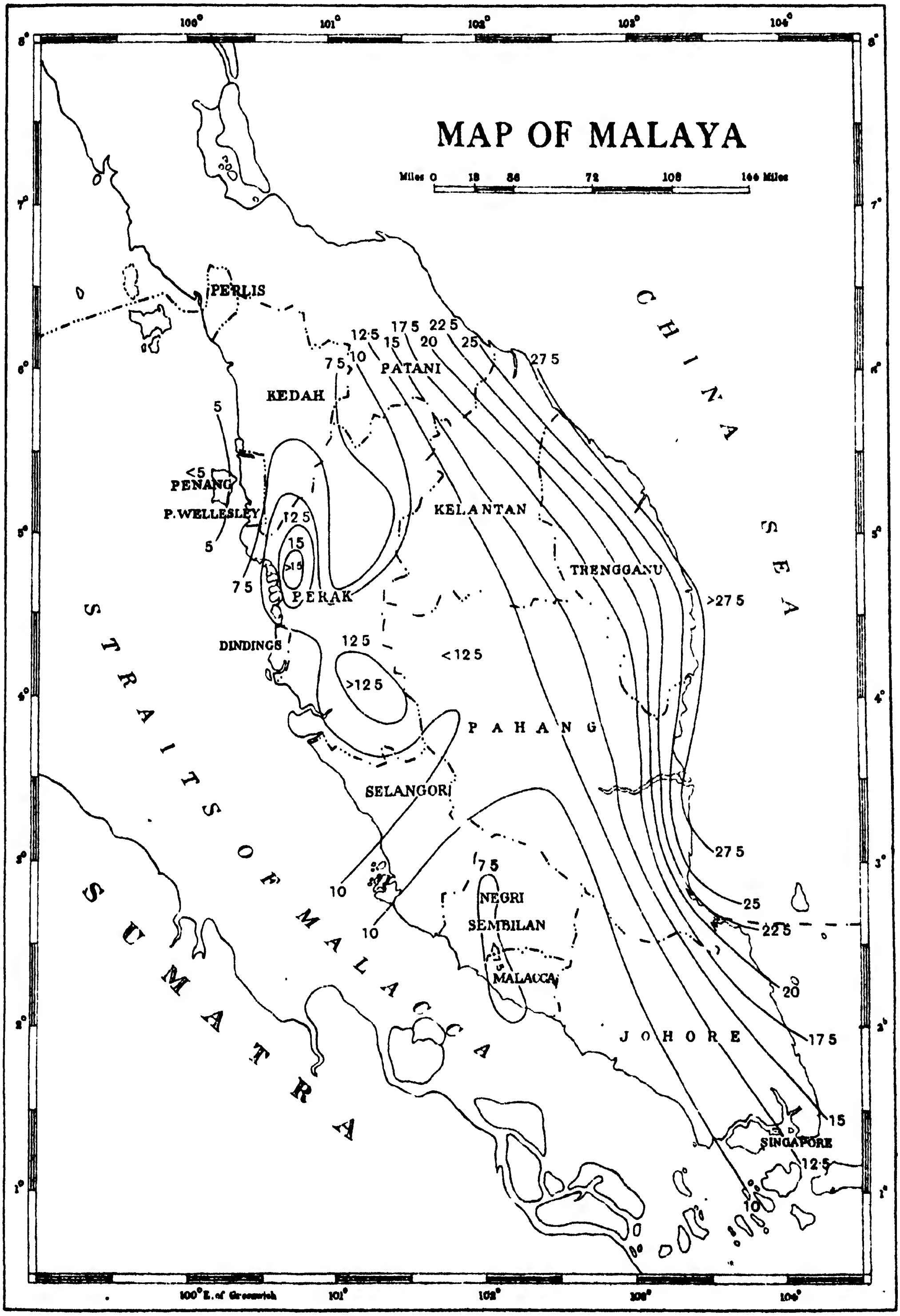


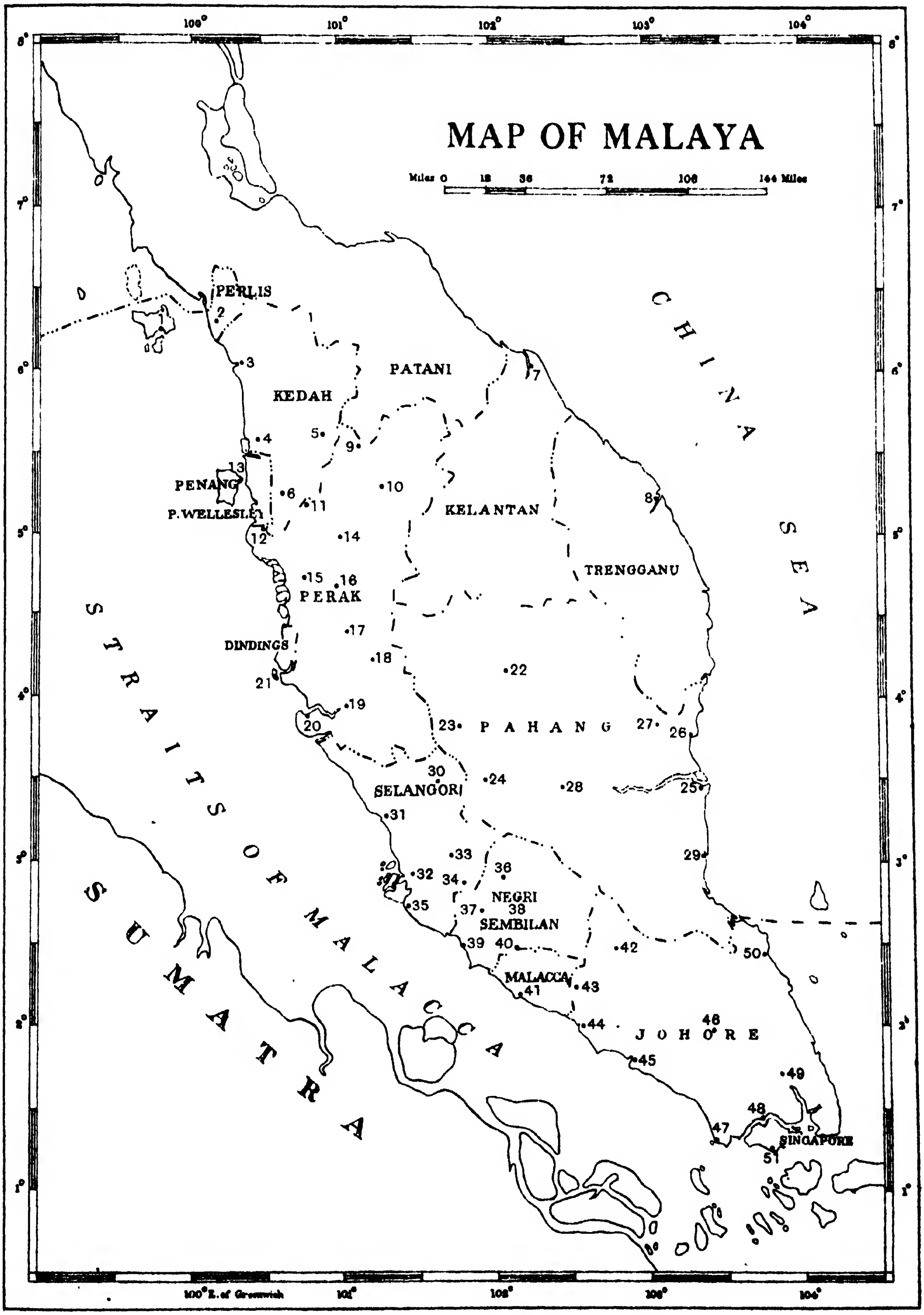
July

INCHES OF RAINFALL



December · INCHES OF RAINFALL




MAP OF MALAYA
Miles 0 18 36 72 108 144 Miles
100° 101° 102° 103° 104°
8° 7° 6° 5° 4° 3° 2° 1°
PERLIS
KEDAH
PATANI
PENANG
P. WELLESLEY
KELANTAN
TRENGGANU
PERAK
DINDINGS
PAHANG
SELANGOR
NEGRI SEMBILAN
MALACCA
JOHORE
SINGAPORE
CHINA SEA
STRAITS OF MALACCA
SUMATRA
100° E. of Greenwich

# A MAJOR PEST OF *DERRIS; NEOLEPTA BIPLAGIATA*

BY

N. C. E. MILLER,

*Assistant Entomologist.*

Tuba (*Derris*) is attacked by several species of insects, chiefly moths, the larvae of which are responsible for an appreciable amount of damage to this important crop. The most destructive pest, however, is a small beetle which has been provisionally identified as *Neolepta biplagiata* Jacoby (Fig. 1). This insect is about three-sixteenths of an inch in length and belongs to the family Chrysomelidae, all the members of which feed on the leaves of plants, and not a few of them, in both the larval and adult stages, are very destructive. The adult beetle has shining brown antennae and legs fairly densely covered with pale tawny hairs. The head is dark brown, with a few pale tawny hairs on the front portion. The thorax is brownish yellow and the elytra (wing covers) are pale brownish yellow with an irregular, broad, dark brown band across the front portion, and with the inner and outer margin narrowly dark brown.

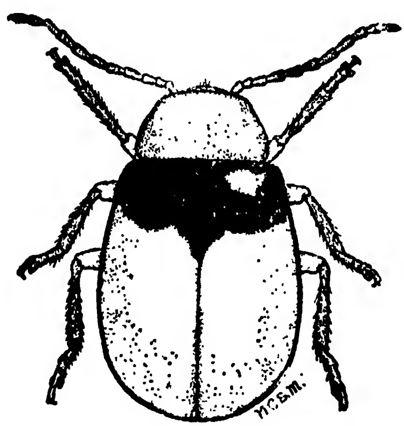



FIG. 1. *Neolepta biplagiata* Jacoby, Adult. (Nat. size $^3/_{16}$ in.)

The wings, which are slightly visible through the elytra, impart a greyish appearance to those parts of the insect.

The underside of the body is brownish and is somewhat thickly covered with pale tawny hairs, particularly on the abdomen.

When almost full grown, the larva, (Fig 2), is about five-sixteenths of an inch in length. It is whitish, with light brown head and legs, and with a light brown

patch behind the head on the first segment, and another similarly coloured patch on the ninth abdominal segment.

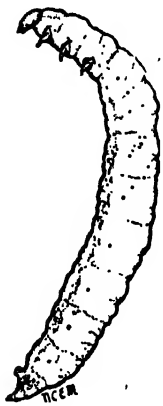


FIG. 2. *N. biplagiata* Jacoby, larva. (Nat. size $^5/_{16}$ in.)

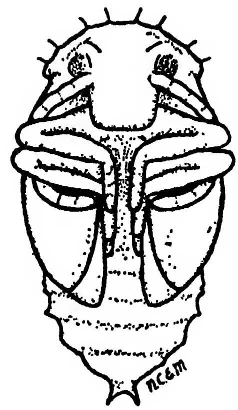


FIG. 3. *N. biplagiata* Jacoby, pupa. (Nat. size approx. $^3/_{16}$ in.)

The head, body and legs are sparsely hairy.

The pupa, (Fig. 3), is also whitish, with a somewhat diffused reddish patch on each side of the head, indicating the position of the eyes.

Behind the head are eight low prominences each bearing a hair.

A short time before the emergence of the adult, the pupa becomes greyish in colour.

The pupa is nearly three-sixteenths of an inch in length.

Owing to failure in obtaining eggs of the beetle, either in the field, or from adults kept in the laboratory, an accurate description cannot be given, but it will perhaps suffice if the following rough outline of the appearance of the egg be given. The egg is oval, somewhat elongate and is broadly rounded at the poles. It is creamy white, smooth and shining and is about one thirty-second of an inch in length. This description is based on the results of the examination of a single damaged specimen.

*N. biplagiata* is destructive while in the adult stage only. It was first reported from Johore in April 1929, when its depredations were giving rise to the opinion that, unless speedily checked, it would bring about the complete destruction of the crop, for although the tuba plant can withstand defoliation once or twice, it rarely, if ever, recovers from the effect of sustained injuries.

The ova are deposited in the soil near the plants, and the larvae on hatching continue to live in the same habitat, and presumably feed on humus.

Both the larvae and pupae are found at a depth of about four inches below the surface of the soil and generally not more than a foot away from the main stems of the plants, but they are also to be found under trailing branches.

As a rule the young leaves are preferred for food, but when they are consumed, the adult turns its attention to the shoots. The damage caused by the feeding of these beetles is conspicuous, the leaves being eaten in an irregular manner, giving them a ragged appearance.

Apart from the sole record made by Mr. F de la Mare Norris of this species feeding on the flowers of *Hibiscus mutabilis* L., there exists no definite information as to its possible alternative host plants, but there is every reason for the belief that such exist in the jungle. Should this prove to be so, the efficacy of measures adopted for control will be, to some extent, lessened, owing to periodic invasions of the beetle.

The danger of invasions can no doubt be mitigated by ensuring that the area chosen for the planting of tuba is as far away as possible from the jungle edge. Nevertheless, even if this safeguard be adopted, there still exists the likelihood of infestation by wind-borne adults.

The control measures which were recommended in the first instance by the Entomological Division of the Department of Agriculture S.S. and F.M.S., were spraying with lead arsenate solution mixed with a spreader such as casein or soap, and hand collecting the adults by means of nets shaped like the usual insect-collecting net, but having the bag made of some stout material instead of mosquito netting, the interior of the bag being smeared with an adhesive substance such as castor oil and resin boiled together.

Both these means were apparently ineffective, perhaps owing to lack of supervision of the personnel employed and to unsystematic spraying, the latter being understandable in the case of one estate, at least, where irregularity of planting and the configuration of the ground possibly militated against efficacy of control. On two estates visited recently, the tuba had been planted out in evenly spaced rows, and on one of these estates spraying operations were being systematically carried out. Two mixtures were in use, one composed of pyrethrum powder, napthalene, fish-oil soap and water, the other containing the same ingredients with the difference that petroleum was substituted for napthalene.

The results obtained, particularly when the latter mixture was used, were highly satisfactory, since it was found that 95 per cent. of the sprayed beetles succumbed. The spray is directed on to the plant from above, whereupon, most, if not all, of the beetles drop to the ground, when they receive a further dose.

On reaching the ground, sprayed beetles begin to run about rapidly and in a confused manner, then, after the lapse of three to five minutes, their movements become slower, and finally, rolling over on to their backs, they expire.

The cost of spraying with these materials is comparatively low, working out at $2/- per acre, exclusive, of course, of expenditure on spraying machines.

An opinion has been expressed, that the cost of spraying might be considerably reduced without loss of efficiency, by the omission of the napthalene or petroleum from the mixture and it is thought that such a mixture is well worth a trial.

It has been noticed that *N. biplagiata* is more abundant after rain has fallen. Although at present one can only theorize on the reason for a sudden increase in the numbers of the pest, it is possible that the softening action of rain on the soil facilitates the emergence of the adults. A hard and parched soil would doubtless assist in retarding emergence from the pupa which is found at a depth of three to four inches below the surface of the soil. A protracted drought, by unduly prolonging the pupal stage, might conceivably destroy a proportion of pupae, particularly any which might be at a greater depth below the surface than is normally the case.

*N. biplagiata* would appear to have few natural enemies.

The Reduviid bug—*Sycanus leucomesus* Walk., a moderately abundant predator of several other species of insects, however, has been observed by Mr. Norris to attack adults, but as a controlling factor, it is of negligible importance.

No instances of the beetle having been devoured by birds have so far been recorded. As beetles of the family Chrysomelidae are rarely preyed upon owing to their distasteful qualities, assistance from birds in reducing the numbers of this pest should not be expected.

The writer wishes to express his thanks for assistance to the Managers of the estates on which investigations were carried out and to Mr. F. de la Mare Norris, Principal Agricultural Officer, Johore, for much useful information.

# THE MUNICIPAL GRANARIES, COLOMBO

BY

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*Agriculturist.*

By the kind permission of the Colonial Secretary, Ceylon, the writer visited the Chalmers Granaries and Manning Rice Markets at Colombo, on the 21st February, 1930, with a view to collecting information as to the general working of these large grain stores.

## Object of Granaries.

With the object of preventing the outbreak or spread of plague in Ceylon certain rules and regulations were framed under "The Quarantine and Prevention of Disease Ordinance, 1897", which are briefly as follows:—

(*a*) All rice imported at the port of Colombo or arriving in Colombo by train from abroad shall be taken to be stored in the Chalmers Granaries or the Manning Markets or such other place as may be approved by His Excellency the Governor, unless removed from the wharf direct by rail to a place outside Colombo.

(*b*) No grain shall be stored in any place which has not been approved by the proper authority, and any grain stored in any place not so approved shall be forthwith removed by the owner to such place as the proper authority may sanction.

The object aimed at by the establishment of rat-proof granaries and markets is the concentration of the grain trade and its isolation from the slums and thickly populated areas.

Plague is introduced into Ceylon by the importation of plague-infected rat-fleas, and rats carrying such fleas, with the grain cargoes coming from other countries or ports where plague is prevalent.

Since it is neither possible to ensure that cargoes shall be free of rats and disinfected at the port of shipment, nor to deal effectively with grain cargoes in Colombo harbour before landing, the only alternative is to deal with the grain after it has landed. In order to minimise, as far as possible, the danger of any plague-infected fleas or rats escaping, and thereby spreading infection among the local rat population, the grain imports are concentrated in rat-proof granaries from which imported rats cannot escape to infect other rats with the fleas carrying the disease.

The Municipality of Colombo constructed two large rice stores for this purpose. One of these is known as the Chalmers Granaries, which is reserved for the wholesale trade, and the other as the Manning Rice Markets, which is employed solely for the retail trade. The two granaries are separate units,

entirely enclosed, and every facility is provided for the enforcement of strict sanitation and a continuous campaign against rats. Both granaries are the property of the Municipality and are under the supervision of the Chairman, Board of Immigration and Quarantine.

## Location.

The two granaries are situated near the Fort Station about a quarter of a mile from the wharf and in the centre of the Municipality. They are, however, about 400 or 500 yards apart and the Chalmers Granaries are connected direct with the railway for convenience of transport. It is essential that such granaries should not be erected adjoining a wharf or on the bank of a river or canal, since the presence of water only serves to introduce rats.

## Construction of Granaries.

The following is a brief description of the general construction of the two granaries, the details of which were kindly supplied by the Chairman, Board of Immigration and Quarantine:—

### Chalmers Granaries.

The Chalmers Granaries were erected in 1915 at a total cost of Rs. 1,722,195/- and comprise ten warehouses containing in all 119 separate stores of various sizes, with a total storage capacity of 2,991,250 cubic feet or approximately 600,000 bags of rice These granaries cover an area of about 11 acres, including roads.

The warehouses are built of reinforced concrete with a series of span roofs supported by steel trusses with box gutters between.

The average height to plate level (the roof being left open) is 16 feet, the distance between trusses is 15 feet and the clear span of roof trusses is 50 feet.

The buildings are constructed with 14 ins. × 14 ins. reinforced concrete piers on reinforced concrete spread foundations. The external walls are filled in between piers with 9 inch reinforced concrete panels.

The floor is of 4 inch setts, set on top of 6 inch concrete with an additional 6 inch of rubble underneath. It is raised about one foot above ground level and slopes outwards.

The roof is covered with Roman Poilite asbestos tiles fixed to reapers supported by 7 ins. × 3 ins. purlins at about 4 feet centres. The doors are sliding and constructed with small channel and angle-iron framing filled in with heavy gauge corrugated iron sheeting.

The warehouses are sub-divided into stores by 9 inch brick in cement walls up to plate level and the portion above is filled in with wire netting.

An open verandah has been provided in front of each store. An iron guard rail, about 18 inches high, is fixed to prevent carts backing close against verandahs.

The whole of the site is enclosed with a substantial brick wall and the gates, which are closed at dusk, are specially constructed to keep out vermin.

## Manning Markets.

The Manning Markets were erected in 1918 at a total cost of Rs. 1,043,976/- for the storage of rice and comprise 59 separate stores with a total storage capacity of 1,024,250 cubic feet, or approximately 200,000 bags of rice. These rice markets cover an area of about 5½ acres, including roads.

The dimensions of the various stores are as follows:—

| | | | | | |
|---|---|---|---|---|---|
| 6 | Stores | 50 | feet | × 50 | feet. |
| 15 | ,, | 50 | ,, | × 25 | ,, |
| 15 | ,, | 50 | ,, | × 20 | ,, |
| 23 | ,, | 25 | ,, | × 20 | ,, |

The stores are built of brickwork 18 inches thick, with tiled roof, reapers and common rafters supported on framed timber trusses.

The height to plate level is 18 feet 3 inches and the distance between trusses 12 feet 6 inches and the span of trusses 25 feet.

The walls between stores are carried up to the underside of rafters.

The floor is of 4 inches setts on 6 inches concrete with an additional 6 inches of rubble underneath.

Doors are wooden sliding doors and are framed, ledged, braced, and battened.

An open verandah 12 feet 6 inches wide is provided in front of each store.

## Method of Rat-Proofing.

The Chalmers Granaries and Manning Markets have recently been rat-proofed and the methods adopted are as follows:—

*Walls*—The face of walls all round the stores inside were chipped and cement rendered very smooth to a minimum depth of 3 feet 6 inches from the bottom of the roof tie beam. At this level a demarcation band of red paint 3 inches wide runs inside and all round the store. This line is intended to serve as a guide to the merchants in occupation of the stores not to stack their goods above this red line. This consequently reduces the stocking capacity of the store. All angles of walls are rounded in cement mortar and space between wall and roof is filled in with brick in cement and sloped. The open gables are screened with wire mesh screens. This method has since been discovered to be insufficiently rat-proof as the rice merchants ignore the red band and stack the rice to the tie beam level. An experimental screen of asbestos has been constructed in one of the stores.

*Doors*—A band of cement mortar 3 inches wide is dubbed out on the wall on either side of the opening and an angle iron 1½ inches × 1½ inches × ⅛ inch is fixed on the top of opening. This is to prevent any space between the wall and the sliding door when the stores are locked.

*Windows and Ventilators*—Those inside the store have been provided with wire-netted screens and the window sill cement-rendered and sloped.

*Gates*—These have been rat-proofed by fixing sliding plates 16 feet long working in grooves made with 2 angle irons 3 inches × 2½ inches × ⅓ inch embedded in cement concrete, the plates being fixed to the gates. This is to check any rats getting in from the ground. The gates are also provided with 3 inches wide iron plates ⅛ inch thick one on either side of the gates, which check any rats entering from the sides.

*Outlets of Down Pipes*—All, outlets of down pipes are provided with rat guards of iron sheeting 3/16 inch thick.

In addition to the above, great importance is attached to the necessity of preventing any flowers, creepers, palms, bushes, etc., being grown against the walls or being kept in the verandahs.

## Lease of Stores.

The various stores are let separately to Rice Dealers on a monthly tenancy at a rental of 6 cents per cubic foot per annum. The tenancy may be terminated by either party giving the other one clear month's notice, but the tenant is required to make a deposit of three months' rent. An extra charge is made for the use of electric light and telephone. Some of the larger stores are provided with small offices and an additional rent of Rs. 5/- or Rs. 10/- per month is charged for single and double offices respectively.

The tenants of the stores are responsible for the cleanliness of their premises.

## Regulations of Granaries.

The general rules, framed for the working of these granaries aim at:—

(1) the prevention of escape from the granaries of rats imported with the grain cargoes;

(2) the prevention of access by such imported rats to water without which they cannot live;

(3) the prevention of the infection by these rats or their fleas of human beings by closing the granaries at night and forbidding people from sleeping in the granaries;

(4) the prevention of access to the area of the granaries of local rats by strict sanitary measures and by forbidding the consumption of meals on the premises or the introduction or collection of food and garbage which would attract or harbour local rats.

Systematic trapping of rats is carried on in the granaries and also hunting of rats when the individual stores are being emptied. A mandor and 5 coolies

at the Chalmers Granaries and a mandor and 2 coolies at the Manning Markets are regularly employed on rat-catching. It is stated that, on the average, each gang will catch from 10 to 15 rats daily.

### Supervision and Labour.

The following list gives particulars of the overseers and labour employed in the working of the two granaries:—

#### Chalmers Granaries.

| | | |
|---|---|---|
| Supervision | ... | 1 Overseer |
| Scavenging gang | ... | 1 Kangany and 10 coolies |
| Rat-catchers | ... | 1 Kangany and 5 coolies |
| Latrine | ... | 1 Coolie |
| Night patrol | ... | 4 Watchmen. |

#### Manning Markets.

| | | |
|---|---|---|
| Supervision | ... | 1 Overseer |
| Scavenging gang | ... | 1 Kangany and 5 coolies |
| Rat-catchers | ... | 1 Kangany and 2 coolies |
| Latrine | ... | 1 Coolie |
| Night patrol | ... | 3 Watchmen. |

In addition to the above, one Rent Clerk is employed in the office of the Chairman, Board of Immigration and Quarantine, solely for the purpose of collecting rents and keeping a record of accounts.

### Costs and Returns.

The following particulars show (a) the cost of the buildings, (b) the value of the land, (c) the annual rent recoverable for occupation of stores, and (d) the annual cost of maintenance, which includes ground rent on land, for both the Chalmers Granaries and the Manning Markets:—

| | Chalmers Granaries. Rs. | Manning Markets. Rs. | Total. Rs. |
|---|---|---|---|
| Cost of buildings ... | 1,722,195.22 | 1,043,976.19 | 2,766,171.41 |
| Value of Land ... | 2,967,000.00 | 267,187.50 | 3,234,187.50 |
| Total value of rents ... | 208,144.20 | 74,415.00 | 282,559.20 |
| Actual amount recovered, financial year 1927—28 ... | 185,843.46 | 74,400.00 | 260,243.46 |
| Total cost of maintenance, financial year 1927—28 ... | 12,946.50 | 12,015.83 | 24,962.33 |
| Nett amount realised less cost of maintenance, 1927—28 ... | 172,896.96 | 62,384.17 | 235,281.13 |
| Total rent recovered from 1915 to end of September, 1928 ... | 2,243,788.64 | 468,486.45 | 2,712,275.09 |

It will be seen from the above figures that the total cost of the buildings and the value of the land amounts to Rs. 6,000,358.91, whereas the total annual rental, if all the stores were occupied at the present rate of 6 cents per cubic foot per annum, amounts to Rs. 282,559.20. After deducting expenses on account of maintenance, the amount recoverable from rents is Rs. 257,596.87 per annum, but, owing to some of the stores not being occupied, the nett amount recovered during the financial year 1927—28 was actually Rs. 235,281.13. This is sufficient to give an annual return of about 4 per cent. interest on the capital outlay.

Further, it is shown that the total rents recovered since the inception of these Rice Stores in 1913 to the end of September, 1928, amounts to Rs. 2,712,275.09.

## General.

It is estimated that approximately 5,000,000 bags of rice pass through these granaries annually, so it will be realised that the project is no small undertaking.

The granaries were constructed essentially for the control of plague, since it is unusual for the rice to be stored in these rat-proof buildings for more than one or two weeks, after which period it begins to lose weight on account of drying.

The authorities do not claim that the system adopted in Colombo is by any means ideal or complete and the Municipality have not yet been able to enforce the regulations as regards the premises of small retail rice dealers who have private grain stores or boutiques in different parts of the city. There is little doubt, however, that the concentration of the wholesale import trade in grain in the Chalmers Granaries and the similar concentration of many of the retail shops in the Manning Markets has been a measure of great sanitary improvement and has assisted materially in keeping Colombo free from any serious outbreak of plague.

Prior to the construction of these granaries and markets the rice stores were scattered all over the city, mainly in the most thickly populated and insanitary areas, which was, naturally, conducive to the rapid spread of infection. As a result of the provision of municipally controlled rat-proof buildings a large majority of these stores have now been closed. It is stated in official reports that, in spite of these precautions, isolated cases of plague do occur in Colombo, but they can be promptly dealt with, while infected rats and fleas can be and are caught in the granaries and destroyed.

The writer wishes to express his indebtedness to Mr. B. G. De Glanville, Chairman, Board of Immigration and Quarantine, Colombo for the valuable assistance accorded to him in the collection of information regarding the lay-out and working of the Chalmers Granaries and Manning Markets.

# Selected Article.

## THE ROLE OF VITAMINS IN STOCK FEEDING.*

BY

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There has grown up during the last few years a very extensive literature on vitamins and minerals. This literature consists mainly of technical papers dealing with the results of research, articles in the popular Press, and propaganda by commercial firms who have put vitamin or mineral products on the market. This great mass of literature is confusing, and some of it is apt to be misleading to stock farmers anxious to apply reliable scientific information in practice. The technical papers are written by research workers for the information of other research workers. They deal with results obtained in laboratories, usually with small animals, and nearly always with special diets which would never be used under farming conditions. The results, therefore, do not apply directly to farming practice. Popular articles and propaganda writing, on the other hand, though on the whole fairly accurate with regard to the facts they do state, tend to magnify striking positive results of experiments to the neglect of negative results, which of course, are of little interest to the ordinary reader. They also overlook the fact that the results obtained in laboratories cannot be applied directly to the totally different conditions of practical farming.

Although in some popular and semi-popular writings the immediate practical importance of the results of recent research on vitamins and minerals has been exaggerated, there is no doubt that the information gained in the last 10 or 20 years is of practical value. Indeed, it is now being applied successfully both in human preventive medicine and in animal husbandry. The present article gives a brief account of recently acquired knowledge and indicates its bearing on practical feeding problems. Unfortunately, although so much experimental work has been done, our knowledge of this "newer" aspect of nutrition is still limited, and our ideas are still growing and changing with the fresh results of research. It is safer, therefore, to regard most of this modern work on nutrition as being still in the experimental stage. There will be no certainty with regard to its practical value until it has been tested and applied under farming conditions by experienced stock farmers capable of forming and expressing an opinion. The following account, therefore, especially in so far as it deals with the practical application of the scientific information which has

* Reprinted from "The Journal of the Ministry of Agriculture," Vol. XXXVII, No. 1, April, 1930.

been obtained in research work, should be regarded as an expression of views rather than a statement of fact. The reader should consider the views or statements set forward here in the light of his own practical experience, and if he should think it worth while attempting to apply any of the information in practice, he should do so as an experiment, noting the results with an open and critical mind. There is a great need at the present time for practical experimental work of this kind carried out on farms to test the value of some recent research, and also to serve as a guide for further research effort in laboratories.

*Vitamins Generally.*—Fresh foodstuffs in the natural state contain, in addition to carbonaceous material, proteins and salts, certain substances and properties termed "vitamins" which are essential for health and growth. An example of these is the antiscorbutic, which is present in fresh fruits and vegetables, and which keeps the body free from scurvy.

One of the most remarkable features of vitamins is the fact that minute quantities produce profound physiological effects. Thus, less than a ten-millionth part of an ounce per day of irradiated ergosterol, a substance which contains Vitamin D in high concentration—if indeed it be not actually Vitamin D itself—is sufficient to keep rats free from the disease which develops in the absence of this vitamin. The amounts of vitamins necessary to maintain health are so small and are so widely distributed in foodstuffs that it is difficult to make up vitamin-free rations. It is usual in vitamin studies to work with synthetic rations, i.e. combinations of specially purified foodstuffs, artificially freed from vitamins.

It is obvious that vitamins do not provide any appreciable amount of energy or heat or of constructive material for the formation of body tissues. Most probably they act by stimulating certain physiological processes. It is possible that they affect the activities of the ductless glands, which produce substances of which small amounts have a profound effect upon growth and health.

Another interesting feature of vitamins is that it has been found astonishingly difficult to isolate them. They can be concentrated in extracts, but as the separation of the vitamins from the other constituents proceeds, the vitamins tend to disappear, or, in other words, the concentrated substance loses its vitamin property.

The vitamins which have been chiefly studied are: Vitamin C, which prevents or cures scurvy; Vitamin B, the absence of which leads to disturbance of the nervous system and the digestive organs; Vitamin A, which is necessary for growth; Vitamin D, which specially affects the metabolism of calcium and phosphorus, and is therefore of importance in the growth of bone; and Vitamin E, the absence of which causes sterility. Recently another vitamin named "G" has been discovered. It appears to have an effect on growth and in maintaining a healthy condition of the skin and mucous membrane of the mouth.

With vitamins should be included the effects of irradiation with ultra-violet light. The invisible light waves beyond the violet end of the spectrum, when directed upon the surface of the body, produce the same beneficial effect as

Vitamin D. When directed on foodstuffs containing a substance known as ergosterol, the foodstuffs acquire the properties of Vitamin D. Ultra-violet light is contained in direct sunlight. It can also be produced artificially by certain kinds of electric lamps.

The chief pathological conditions which develop when the various vitamins are not present in the diet have been indicated above. The evil effects of vitamin deficiency are, however, not limited to these gross disorders. Diets or rations may contain sufficient of any vitamin to prevent the onset of these gross symptoms of disease, but still not contain sufficient for the maintenance of perfect health. Thus a diet may contain sufficient of Vitamin B to prevent the onset of the typical symptoms of beri-beri, but not sufficient for perfect health, and the animal, though not showing the signs of beri-beri might still suffer from imperfect functioning of the digestive organs and a resulting degree of general malnutrition.

Fortunately, all natural foodstuffs are comparatively rich in most of the vitamins. Thus, fruits and vegetables, grass, roots and tubers, are especially rich in Vitamin C. In cereals, Vitamin B is contained chiefly in the seed-coats. Hence, all whole grains or offal are rich in Vitamin B. Green food, such as grass, is rich in all vitamins, and is especially rich in both Vitamin A and Vitamin D. Vitamin E is also widely distributed in foodstuffs.

The danger of vitamin deficiency arises on diets or rations consisting of materials which form only a part of the natural foodstuff, as, for example, wheat flour or polished rice. In both these cases the vitamin is removed in the process of milling. Cooking tends to destroy the vitamins; hence foodstuffs which have been cooked and preserved are, in general, poorer in vitamins than fresh foodstuffs.

Most of the experiments which have been made to determine the amounts of vitamins present in different foodstuffs, or the effects of the absence of vitamins, have been carried out with small animals, e.g. guinea-pigs and rats, fed on special diets consisting of substances from which all the vitamins naturally present in the original foodstuff have been removed or destroyed. The results of these experiments, while of great scientific interest have of course no direct bearing on stock farming, because the kinds of rations used in these experiments would never be used on a farm, and, further, because the requirements, for some of the vitamins at least, are not the same for different species of animals. The only experiments of immediate practical value for stock breeders are those done on farm animals with rations such as would be used on a farm. Fortunately, a number of these have been done. The practical bearing of these may be considered under the heading of the different vitamins.

*Vitamin C.*—The only animals that seem to suffer to any marked degree from deficiency of this vitamin are monkeys, men and guinea-pigs. There is, therefore, no evidence that it is of great practical importance in stock farming. It has been shown that cattle and poultry do not suffer from deficiency of Vitamin C in the food, and tests with pigs have shown that they can remain in good

health without any sign of scurvy for at least three or four months, though fed on a diet devised to contain as little of the vitamin as possible.

The writer is not aware of any definite tests having been done on horses. On the other hand, he has not seen any reports indicating a wide occurrence of scurvy among them, although many horses are fed for long periods on rations such as hay, oats and other grains which have little or no Vitamin C. It is possible, of course, that though gross signs of scurvy may not appear, deficiency of this vitamin may be the cause of a minor degree of malnutrition which, if long continued, may manifest itself in increased susceptibility to other diseases. It would be interesting to compare the condition and freedom from disease of town horses which regularly receive some foodstuff rich in Vitamin C, e.g. roots or tubers, with others not receiving this, but on an otherwise similar diet.

*Vitamin B.*—This vitamin, which prevents beri-beri, is so widely distributed in foodstuffs e.g. grass, wheat offal, grains, roots and tubers, that there is little likelihood of a deficiency in any ordinary ration. Further, the results of a number of tests with cattle carried out by Sir Arnold Theiler in South Africa show that it is a matter of considerable difficulty to produce any signs of deficiency of this vitamin in cattle, even with rations specially prepared to be as free as possible from it.

Fowls are especially susceptible to beri-beri, but as the foodstuffs used for poultry consist largely of wheat offal and grains the danger of deficiency of Vitamin B is not great. Yeast is especially rich in this vitamin, and the addition of yeast to poultry rations has been advocated as a means of providing a rich supply. Yeast is rich in protein and mineral matter, which are required in large amounts by laying hens. The addition of yeast to ordinary rations is likely to be of value, even though an additional supply of Vitamin B is not required, but in tests carried out with well-balanced rations containing sufficient protein and mineral matter, the addition of yeast to the ration was not accompanied by any increase in eggs or better health in the fowls.

*Vitamin A. and D.*—The two vitamins which seem to be of greatest importance in stock farming are Vitamin A, which promotes growth, and Vitamin D, which promotes healthy growth of bone. For a time Vitamin D was not recognized as a separate entity from A, and the earlier tests were done with substances such as cod liver oil and green food, which contain both. They may therefore be considered together.

Of the two, Vitamin D is probably the more important. Young animals fed indoors in winter are liable to have a diet deficient in D, with resulting imperfect bony development. It has been shown that if chickens be reared indoors without any sunlight and with no green food they are liable to develop "leg weakness," which is believed to be due, partly at least, to deficiency of Vitamin D. In the same way young pigs after weaning are liable to suffer from rickets, a disease in which there is imperfect development of the bones, and which is liable to occur in young pigs fed indoors on cereal rations.

One of the richest sources of Vitamins A and D is cod liver oil, and the

addition of a small amount of this oil to the rations of chicks and young pigs reared in confinement has proved of very definite value in keeping them free from these diseases. Green food, which is rich in Vitamins A and D, will, of course, have the same effect in promoting health. As has been noted above, ultra-violet light, which is available in the sunshine, supplies or replaces the necessary Vitamin D. A run outside, therefore, is in many cases as valuable as feeding substances rich in Vitamin D. It should be noted that fowls kept under ordinary conditions, with an outside run on grass get all the Vitamins A and D they need. Extensive tests have shown that the addition of cod liver oil to rations otherwise well balanced produces no increase in egg yield if fed to fowls kept under ordinary practical conditions with a run on pasture, as most fowls on farms are. In intensive methods of poultry farming, however, when fowls are kept continuously indoors with no green feed, the addition of cod liver oil to the extent of 2 to 4 per cent. of the ration would probably have a beneficial effect. Tests in the United States have shown that the addition of cod liver oil resulted in increased egg yield, and increased hatchability of eggs and viability of chicks.

*Vitamin E.*—Experiments with Vitamin E, which is believed to affect reproduction, have been carried out only on rats. Whether or not deficiency of this vitamin affects reproduction in farm animals is unknown. On the whole, as Vitamin E is so widely distributed among foodstuffs, it is unlikely that under ordinary conditions a marked deficiency would occur. Arising out of the work on Vitamin E with rats, however, sprouted oats have been tried in the treatment of sterility in cattle in America, and to a less extent in this country. There appears to be some doubt as to whether sprouted oats contain Vitamin E, but the experiments made, although inconclusive, indicate a possible beneficial effect. It is said that fertility has been restored to infertile bulls and the number of services required by cows reduced.

It will be seen that, as far as our knowledge goes, with the exception of Vitamin D, there is not much likelihood of deficiency of vitamins occurring in practice. If, however, deficiency of vitamins be suspected in some rations, vitamin-rich foodstuffs are constantly at the farmers' hand. Green grass, grains, roots and tubers, are easily available. If he wishes something in addition to these, cod liver oil as a supply of A and D, and yeast as a supply of B, can easily be obtained. A dessertspoonful of cod liver oil per head per day should supply sufficient vitamins A and D for large animals, and 4 oz. per 10 lb. of mash are sufficient for fowls. There is no need whatever for any stock feeder to purchase any highly priced foodstuffs merely on account of the fact that they are alleged to be specially rich in vitamins.

# Abstracts.

## NOTES ON OIL PALMS IN ANGOLA.*

The article is accompanied by a map of the territory between 4° and 17° southern latitude and between 12° and 24° eastern longitude shewing the oil palm areas.

The territory naturally falls into three zones: the coastal zone, the hillslope zone, and the upland plains zone. The chief climatic difference is the comparative dryness of the coastal zone in contra-distinction to the heavy rainfall in the other zones.

In the coastal lone, the oil palm grows spontaneously between 4° 41′ and 12° 20′ southern latitude and under cultivation as far south as 13°; exclusively along the river banks or alluvial humus-containing sand or loam soils, but never on marshy soils.

In the hill slope zone, soil and climate are suitable, but the competition with other forest trees prevents the oil palm from dominating the forest. The soil is predominantly a humus-containing clay loam.

In the upland plains, except in a few areas, the oil palm is rarely found, and never above 4,000 feet in altitude. In this area, its growth is much slower than in the lower zones.

Nearly all known varieties of *Elaeis guineensis* Jacq. and of *Elaeis Poissoni* E. Annet, are found in Angola. Mention is made of a variety of the latter that apparently has not yet been found elsewhere in Africa. The name *E. Poissoni* Var *dura virescens nigrescens* is proposed for this variety. According to Janssens and Amaral, the fruits on the outside of the fruit bunches of this variety are black with an orange or green patch at the side turned away from the light. The fruits inside the bunch are orange coloured, with a green base and a green tip; some of these fruits are orange all over and others are orange with violet strips. The sterile carpels forming the sheath are white at the base, green in the middle and violet at the tip. The theory is advanced that this is not a type but a cross between *nigrescens* and *virescens* varieties.

As in other parts of Africa, the varieties *sempernigra* and *communis, forme dura* are most prominent.

Analyses show that the fruit of the oil palms in Angola is very similar to that of the palms in other parts of Africa. The analyses of the fruit of *Elaeis Poissoni,* var. *tenera negrescens* demonstrate that in the matter of selection of high yielding types, evidently there is still a great deal of work to be done.

It is estimated that in the coastal zone, the average annual yield per palm in the natural palm forests is 7 to 9 kilograms of palm oil and 4 to 5 kilograms of kernels. Though in the coastal zone and on the hill slopes the palms bear

*An abstract of a translation of "Renseignements sur se Palmier à Huile en Angola" par C. de Mello Geraldes. From Anais do Instituto Superior de Agronomia—Vol. III. Lisbonne, 1929.

fruit throughout the year, harvesting can only be done during 8 to 9 months per year.

As elsewhere in Africa, the bulk of the produce exported from Angola comes from native holdings. The number of European proprietors and estate factories, however, is increasing. These estates exploit not only natural forests but are establishing plantations from nursery grown seedlings.

One company "Fomento Geral de Angola" is especially mentioned as planting on its estates exclusively the variety *communis* type *tenera* and the varieties of *Elaeis Poissoni.*

A comparison between varieties with a thick shell and those with a thin shell, especially in respect of the vitality and productivity of the various types under natural conditions, leads to the conclusion that selection should aim at establishing a thin shelled type of high oil percentage which would offer the advantage of simplifying the mechanical processes of extraction and separation and of improving the final results.

The figures of exports of both palm oil and of kernels from Angola from 1910 to 1928 show that the annual production varies greatly; for palm oil the variation is from 901 tons to 4,630 tons and for kernels from 4,370 tons to 8,588 tons. For neither product is there any tendency towards steady increase or decrease. Kernels form about two-thirds of the total export though the yield of palm oil per palm is about twice as much as the yield of kernels.

## PINEAPPLE BRAN.*

The origin of some feeding stuffs is, to say the least, unusual, and it may be taken that pineapple was not suspected by many readers as providing the source of a very useful material. In the process of canning these fruits, the cores and trimmings which are discarded, are extracted and, by a special drying process, are converted into a palatable dairy and stock food. At the cannery of the Hawaiian Pineapple Cannery, Honolulu, all the waste in the form of skin, defective pieces, cores and trimmings is washed in pineapple juice and screened. The material is next conveyed to the sugar mill, which expresses the juice from the skins and cores, and it is then run through shredders and blown into a revolving drier 8 feet in diameter and 30 feet in length. Here it is thoroughly dried by hot air, and, as the drum slowly revolves, the bran is worked to the discharge ends by means of baffles. As it is discharged from the drum, it passes into a special machine which removes any metallic pieces it may contain, and the bran is then sacked in 100 lb. bags. On analysis, this pineapple bran shews a protein content of 3.62 per cent., with 1.01 per cent. of oil, 18.23 per cent. of fibre, 20.66 per cent. of sugars, 42.16 per cent. of other carbohydrates, and 3.7 per cent. of ash or mineral matter. Although the Hawaiian Pineapple Company only began manufacturing this bran some six years ago, it is stated in *Foodstuffs* that the demand exceeds the supply.

*From—*The Fertiliser Feeding Stuffs and Farm Supplies Journal*, July, 23rd, 1930.

# Reviews.

## The Biological Control of Insect and Plant Pests.

BY

W. R. THOMPSON, Ph.D., D.Sc.

*Issued by the Empire Marketing Board, June, 1930. Printed and Published by His Majesty's Stationery Office, London. Price 1s. net.*

This publication is the first Report on the organisation and progress of the work of Farnham House Laboratory.

The Laboratory, situated about 2 miles from Slough, was founded by the Imperial Bureau of Entomology (now the Imperial Institute of Entomology) in 1927 by means of a grant from the Empire Marketing Board. Its principal object is the furtherance of the control of insect pests of agriculture and forestry in the British Empire by what is known as the biological method; that is, by means of beneficial parasites and predators. The work commenced in June, 1927, and up to the end of June, 1930, requests for parasites and predators of seventy injurious insects had been made. In addition to the above, investigations on the insect enemies of certain weeds were taken over at the request of the Government of the Dominion of New Zealand.

The Report is divided into five parts of 124 pages consisting of:—I. An Introduction, II. The Principles and Organisation of Work on Biological Control, III. Farnham House Laboratory: its Resources, Equipment and Staff, IV. Practical Work and V. Bibliography.

A general account of the way in which work on biological control is planned and executed at the Laboratory is given in Part II in order to convey some idea of the principles underlying it and of the technique used in practical work.

The first section deals with the Principles of Biological Control. The practice of biological control owes its origin to the fact that a great many injurious insects and plants are attacked by parasitic and predacious species belonging to the same group and further, many plants injurious to agriculture and forestry have also their insect enemies. Then insect pests which are accidentally imported to new countries leaving their habitual parasites and predators behind, frequently become extremely numerous and cause immense damage, for experience has repeatedly shown they are generally attacked to only a negligible extent by the beneficial species existing in their new homes. Of the 183 worst insect pests existing in North America, almost half have been introduced, mostly from Europe. In former times no regulations existed that were designed to prevent the importation of insect and plant, but as transport was very slow and no means of preserving foodstuffs existed, opportunities for the migration of injurious insects were not really very numerous; but the development of world trade has permitted and fostered cosmopolitan tastes and requirements which in turn further stimulate commerce between the various parts of the globe. The increase in the development of world trade has thus, as a necessary consequence, caused an increase in the rapidity of the dispersion of pests.

A discussion concerning the disadvantages of mechanical control follows. As an instance, in certain parts of the world, the amount of arsenic used during the ordinary treatment against the Codlin Moth in apples is so great that the arsenical residue on the fruit at the time that it is gathered is dangerously large and has to be removed by special processes, so that in view of the cost of and the repeated applications of poisons and similar methods of control, entomologists are now attempting to utilise the parasitic and predacious enemies which attack injurious insects in nature.

The Hawaiian Planters' Association and the United States Bureau of Entomology have for a long time maintained a special staff of entomologists to deal with the biological control of insects. Until quite recently, work on biological control of insects within the British Empire has not been actively pursued. In Australia and New Zealand the effort to bring injurious plants under control by phytophagous insects is now being carried out on a more comprehensive scale than in any other part of the world.

Further subjects discussed in this Part are concerned with preparatory work dealing with the importance of the correct identification of insects and of a bibliographical service; a preliminary field survey; the careful examination of the material which has been collected in order to decide that the insects are really parasitic or predacious on the pest to be studied; and the choice of the species to be utilised in which the habits, especially the reproductive rate, will influence the final selection. In this Section the subject of miscellaneous introductions of parasites which may come into conflict with each other in the field is discussed.

Following the section dealing with the Choice of Species is a section treating with large scale collection and shipment in which are discussed the introduction of parasites either at first by breeding from a small stock collected in the field or by collecting large numbers of the parasite in its native home. Each method has its advantages and disadvantages and depends very largely on the habits of the species to be introduced. Further sections have most useful information concerning the Methods of Treatment on Reception, the Study of the Progress of Introduced Parasites in the Field and the Results of Experiments in Biological Control.

Part III of the Report deals with Farnham House Laboratory, and is divided into sections dealing with Finances, Grounds, Buildings and Equipment and Staff.

In his summary to this Part, the Author points out the necessity for the development of work on biological control in view of the fact that the basic foodstuffs of Europe are of fundamental importance to its colonies and that the insect pests of the plants and animals utilised in Europe are, therefore, amongst the most important in relation to the agriculture of the Empire. The situation of the Imperial Institute of Entomology is, it is claimed, the most convenient possible in that it enables such investigations as are necessary to be conducted with greater efficiency, rapidity and more cheaply than would be the

case if investigators from the Dominions and Colonies had to proceed to Europe to carry out the particular work affecting their territory. The mobile and flexible organisation visualised is stated to be in a better position to seize opportunities for practical work than are agents sent especially from distant points.

In connection with these claims the reviewer is not entirely in agreement. One cannot preclude the desirability of workers in one country visiting other countries—perhaps far distant—in connection with such problems. That this view is also held in other countries is shewn, for instance, by the fact that the United States Bureau of Entomology, the Fiji Government, and the Hawaii Sugar Plantations still consider it necessary to send representatives to Malaya and near-by countries without previous knowledge of those countries to investigate parasites of various insects and to superintend the selection, the breeding and the transportation of parasites.

The section dealing with the practical work undertaken up to the present time describes the various practical operations together with the methods which have been employed in particular cases and the results which have been obtained to date.

This section deals with Parasites of Deciduous Fruit Insects; Parasites of Forest Insects; Parasites of Cereal and Forage Crop Insects; Parasites of Insects of Vegetable and Garden Crops; Parasites of Tropical Field Crop Insects; Parasites of Citrus Fruit Insects; Parasites of Greenhouse Insects; Parasites of Insects affecting Man and Domestic Animals; Investigations in the West Indies, concerning parasites of sugar cane borers and Noxious Weed Work which comprises the utilisation of insects to control noxious weeds of European origin in New Zealand.

In addition to the above series, theoretical studies on the problem of natural control are being conducted.

Up to the date when this publication was sent to the press, a total of 73 consignments of beneficial insects, containing approximately 285,000 living individuals have been sent out of the Laboratory and in these shipments 24 species of beneficial insects attacking 17 species of pests have been included.

Most of the projects deal with insects in the Dominions, Canada, Australia and New Zealand, and the names of Tanganyika, Uganda and Kenya are missing from the list. It is conceivably possible that these colonies in future will have their own parasitic station to deal with the principal pests.

Altogether a most practical and informative report having a distinct interest not only to the entomologist but also to the general public.

The staff has every reason to be proud, with the enormous number of parasites it has dealt with in such a comparatively short time, and the public will welcome the publication of this concise statement setting forth the achievements of the Imperial Institute of Entomology for the biological control of pests in the British Empire.

G.H.C.

## Prospectus of the Government School of Agriculture, Malaya.

The Government School of Agriculture, Malaya, situated at the Government Experimental Plantation, Serdang, about 14 miles by road from Kuala Lumpur, will, it is anticipated, commence work in May, 1931. The Prospectus which has just been published states that there is, at present, accommodation for eighty students. Such students are arranged in four groups, viz: Agricultural Students in Training, i.e. Asiatics who have been appointed by Government with a view to subsequent employment as Agricultural Assistants in the Department of Agriculture; Agricultural Pupils, i.e. Asiatics who have been appointed by Government with a view to subsequent employment as Agricultural Subordinates in the Department of Agriculture; Scholars, i.e. students to whom scholarships have been awarded either by Government or by non-Government institutions or persons; and Private Students, i.e. students other than those described above.

The principal course of instruction, covering a period of three years, is conducted in English and provides a scientific training in Tropical Agriculture, with special reference to local conditions. The minor course, lasting one year, is conducted in the Malay language and provides a practical training in the agriculture of the major crops of the Malay Peninsula.

The Prospectus gives full details regarding the appointment of Agricultural Students and Pupils and the admission of Private Students, together with the syllabus of instruction in respect of each course.

The School was designed primarily for the training of the Asiatic staff of the Department of Agriculture. Hitherto, such instruction has been conducted at Kuala Lumpur under somewhat inadequate conditions. With the provision of the new School, to which is attached a Hostel in which all Students are expected to reside during term, it is anticipated that not only will the course more adequately fill the needs of the Department of Agriculture, but that by the inclusion of Private Students, a long felt want in Malaya will be satisfied. Asiatics own land and manage estates—some of considerable area—which in the aggregate embrace the greater part of the agricultural activity of Malaya. It is thought that the provision of this School, where for the payment of moderate fees, the sons of well-to-do Asiatics can obtain a grounding in scientific agriculture and its practical application in Malaya, will be appreciated by parents who may desire that their sons shall assist, intelligently, in the management of their property.

Copies of the Prospectus may be obtained free on application to the Director of Agriculture, Kuala Lumpur, F.M.S.

D.H.G.

## THE SECOND INTER-DEPARTMENTAL AGRICULTURAL CONFERENCE, KUALA LUMPUR.

The Second Inter-Departmental Conference was held at Kuala Lumpur under the Chairmanship of Dr. H. A. Tempany, Director of Agriculture, S.S. & F.M.S., from October 27th—November 1st, 1930 inclusive. In addition to the officers of the Department of Agriculture, the following departments took part in the Conference: The Rubber Research Institute of Malaya, the Co-Operative Department and the Veterinary Department.

The Hon'ble the Chief Secretary to Government, F.M.S., Mr. C. W. H. Cochrane, C.M.G., opened the Conference with a speech in which he shewed as well as voiced his interest in the Department of Agriculture and his confidence in the value of the Conference. In the course of his speech, Mr. Cochrane announced that he appreciated the necessity of more adequate buildings for the Department, in consequence of which provision for new buildings was included in the 1931 estimates. He had watched with interest the development of the Department for the past thirty years, and although during the early years attention was devoted mainly to rubber, in latter years the Department's sense of proportion had become adjusted and the scope of these activities had been widely extended, with excellent results. Moreover, the Department was in touch with and had the confidence of the public, which was beginning to realise that success in agriculture was derived from the application of scientific principles to the many problems with which it was confronted.

The Chairman after thanking the Chief Secretary for his speech outlined the objects of the Conference as follows:—

To assist in defining departmental policy.

To discuss and classify details in relation to various points of this policy.

To promote contact between the field staff and the research staff of the Department of Agriculture and to secure better understanding of the relations of the work of these and other branches; and

To facilitate contact and discussion between the branches of the Department and other Departments of the Government service as well as the Rubber Research Institute, in relation to common lines of work.

The former Conference he described as a business gathering and he wanted to emphasise that in organising the present one the business aspect of the proceedings had again been kept in view.

As the result of the last Conference a series of decisions was arrived at in relation to a number of lines of work. It was interesting to record that practically without exception these had been translated into action during the past twelve months.

Dr. Tempany proceeded to review the development of work during the year. Much of this development was assisted by the findings of the previous

Conference. Closer contact existed between the field and research divisions and the scope of the former division was now more clearly defined.

A scheme of re-organisation of the work of the department had been submitted to Government and in framing these proposals the findings of the previous Conference were of great assistance. The standardisation of the departmental exhibits at all agricultural shows in Malaya was a further outcome of the last Conference.

Without attempting to anticipate or to review in advance the nature of the discussions in the present Conference, the Chairman pointed out the importance of such subjects as were included in the programme under padi, statistics, and in particular, the commercial and economic aspects, which were of particular interest to the Department of Agriculture and the Co-operative Department.

Alluding to stock, Dr. Tempany welcomed particularly the representatives of the newly-constituted Veterinary organisation of the Government. The exact part of any stock policy which might hereafter devolve on the Department of Agriculture and the Veterinary Department respectively remained to be decided, but there was no question that the interests of the two organisations were closely interwoven and he was hopeful that the inclusion of stock problems in the work of the Conference and the attendance of the representatives of the Veterinary Department would be as productive of satisfactory results as already had been co-operation between the Department of Agriculture, the Co-operative Department and the Rubber Research Institute.

The remainder of the morning session of the Conference was devoted to the consideration of schemes in relation to demonstration plots, and details of the lay-out of such plots; standardisation of work in school gardens and the manner in which instruction should be given; measures for the destruction of rats; and the work of Chinese Sub-Inspectors of Agriculture and the desirability of extending these services to parts of the Peninsula where at present they do not exist.

In the afternoon, a sub-committee considered subjects concerning questions of internal economy in the Field Division.

The Tuesday Session of the Conference was devoted to questions in relation to padi cultivation. In this connection the following papers were submitted.

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|---|---|
| "Some recent application of statistical methods" ... | by Mr. R. G. H. Wilshaw. |
| "Experiments on padi" ... | by Dr. H. W. Jack. |
| "Measures to be adopted for the distribution of selected strains of padi seed together with a survey of results achieved to date in padi distribution" ... | by Dr. H. W. Jack. |

"Recent views on general characteristics and standard methods of treatment of padi soils" ... by W. N. C. Belgrave.

"Mechanical cultivation of rice" ... by Messrs. C. L. Newman and J. Lambourne.

"Recent work on padi stem borers" ... by Messrs. G. H. Corbett and H. T. Pagden.

"The collection of statistics in relation to the padi crop" ... by Mr. J. Gordon-Carrie.

As will be seen from the above titles the production of rice was reviewed from many points of view. Questions of soil selection, seed selection, manuring and control of pests were discussed; and the importance of improvement in methods of collecting statistics was considered and eventually referred to a sub-committee. This committee reported its recommendations, which were adopted, at the last session of the Conference.

The possibility of producing padi on a large scale was emphasised not only by the paper prepared by Messrs. Newman and Lambourne, but by the account of the successful cultivation by means of modern machinery in South Siam. The latter account will be found in this number of *The Malayan Agricultural Journal.*

In the afternoon the delegates visited the Coconut Experimental Station, Klang.

Wednesday, October 29th was devoted to Rubber. Papers introducing discussions were as follows.—

"The application of bud-grafting to kampong conditions" ... by Mr. C. E. T. Mann.

"Co-operative Rubber Societies among Malay small-holders" ... by Mr. F. G. Spring.

"Preparation of rubber from the point of view of small-holders" ... by Mr. R. O. Bishop.

"Oidium and Mouldy Rot with special reference to small-holdings" ... by Mr. F. Beeley.

"Difficulties of the control of pests and diseases in the field" ... by Mr. F. de la Mare Norris.

"The chemical manuring of rubber" ... by Dr. C. F. Flint.

From the above, it will be seen that the problems considered were mainly in connection with the cultivation of rubber on small-holdings. The chief point that emerges from these papers and the discussions is the reliance which both the Department of Agriculture and the Rubber Research Institute place in educational means of various descriptions to induce the small-holder to improve his methods of cultivation and to guard against the dangers of pests and diseases, rather than on legislation.

Later, the delegates inspected the Rural Lecture Caravan, inaugurated by the Departments of Agriculture and Co-operation and the Rubber Research Institute which will constitute a travelling exhibition and from which lectures and educational cinematograph shows will be given.

In the afternoon, a visit was paid to the headquarters of the Rubber Research Institute where the delegates witnessed a demonstration of sulphur spraying methods and inspected the laboratories.

Thursday, October 30th, was devoted to problems concerning coconuts, oil palms, tea and pineapples, and in addition agricultural problems in Johore and Kedah. Two papers on the agricultural problems of Pahang East and Singapore were, on account of pressure of time, held over till the Saturday session.

The morning programme of subjects was as follows:—

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|---|---|
| "Cultivation of coconuts on heavy soils with special reference to soil type, water table, plant food requirement" | by Mr. W. N. C. Belgrave. |
| "The present day position in relation to copra research and practical issues concerned therewith" . | by Mr. F. C. Cooke. |
| "Insect pests of the coconut palm" ... | by Mr. G. H. Corbett. |
| "Some practical considerations in relation to the cultivation of the oil palm" | by Mr. B. Bunting. |
| "Tea and other crops in Ceylon and India" ... | by Mr. E. A. Curtler. |
| "Proposals for the establishment of experimental work on pineapples in Singapore" ... | by Mr. J. W. Jolly. |
| Agricultural Problems in— | |
| (a) Pahang East ... | by Mr. J. M. Howlett. |
| (b) Johore ... | by Mr. F. de la Mare Norris. |
| (c) Kedah ... | by Mr. W. N. Sands. |
| (d) Singapore | by Mr. J. W. Jolly. |

In the afternoon papers on agricultural co-operation among small-holders by Mr. F. G. Spring, and Government produce purchase schemes by Dr. H. A. Tempany were the subjects for discussion.

A good deal of interesting discussion was provoked by the papers and it is believed that they serve to some extent to clarify the position.

The consideration of Government produce purchase schemes was the subject of much discussion in which the arguments for and against were stated, and the relationship of such schemes with the work of the Co-operative Department was emphasised. A sub-committee was formed, consisting of representatives of the Department of Agriculture, the Co-operative Department and the Rubber Research Institute to consider the advisability of adopting such a scheme and its application to the larger native agricultural industries of Malaya.

Live Stock questions were considered at the Friday sessions.

Mr. B. Bunting read a paper on "Cattle at the Government Experimental Plantation, Serdang" which gave an account of the work performed at that Station in relation to the improvement of dairy cattle.

Dr. Tempany described the progress of dairying work in Malaya and pointed out the scope which exists for local milk production. He described the various efforts in relation to Government dairies in other Colonies with which he was familiar and indicated that no real difficulty existed in Malaya in the way of producing milk equal to the best grade milk sold at Home.

In the subsequent discussion, considerable divergence of opinion was found to exist as to the desirability or otherwise of making crosses the basis for the improvement of milk in Malaya.

The control of disease, including that of piroplasmosis was discussed, and it was stated in East Africa control of this and even more deadly diseases had been attained by various methods.

Mr. R. McGregor opened a discussion on the buffalo problem in Pahang. He pointed out the importance of the buffalo in the economy of the ryot, its hardiness and value as a milk producer. He put forward certain suggestions for the improvement of the buffalo and indicated that the best line would be the establishment of a Government stud-farm where improved breeds of buffaloes could be raised, the stationing of bulls in selected country districts with a view to improving the breed and the elimination of the practice at present prevailing of breeding from unsatisfactory sires.

Mr. Bunting opened a discussion on the improvement of pigs in Malaya referring to the pig breeding work and experience gained at the Government Experimental Plantation, Serdang.

In the subsequent discussion attention was given to the dissemination of information amongst Chinese agriculturists in relation to breeding of pigs, the desirability of arriving at a type of pig acceptable to the local market and the elimination of unsatisfactory sires.

The concluding paper of the morning session dealt with the breeding of sheep in Pahang, Captain Howlett describing efforts in progress in Pekan to improve the breed of sheep on the East Coast. The East Coast is the only part of Malaya where sheep-raising has been undertaken satisfactorily and some of the difficulties incidental to the work were described.

The suggestion was made that it might be possible to introduce a type of sheep common in Nigeria, as a possible means of improving the size and grade of the sheep native to the East Coast.

Incidentally, it was mentioned that the cognate subjects of goat-rearing and poultry raising required attention. It was stated with regard to both, that the subjects were under consideration by the Department of Agriculture, which, however, as yet made no definite pronouncements on either.

The afternoon session was devoted to the question of plant quarantine measures in Malaya. The subject was opened by Mr. F. W. South, who

summarised the existing measures and stated the difficulties inherent in their application and made suggestions for possible improvements.

After considerable discussion it was resolved that a certain number of points were indicated for improvement in the existing services. It was decided that it was necessary to decide upon the plants and the pests and the diseases against the introduction of which it was essential that Malaya should protect itself and that the necessary steps should be taken to ask for effective quarantine measures in respect of these particular plants and pests.

The final session of the Conference was held on Saturday morning, November 1st, at which Mr. Sands read his paper on agricultural problems in Kedah and Mr. Jolly on the problems of Singapore. Extensional work in the Unfederated Malay States was considered in the discussion of the former paper; while the dependence of Singapore on importations of fruits and vegetables from Java and Sumatra was stressed in the discussion of Mr. Jolly's paper. It was urged that at the present time this import trade represented a huge export of capital from Malaya, a considerable part of which could be kept in the country, but that efforts were needed in order to bring this about.

The arrival of some means of estimating bark consumption on small rubber holdings formed the final subject for discussion. Many difficulties in this connection were discussed. Finally, an inter-departmental committee was appointed to consider the matter further and to make recommendations for a satisfactory system of making these measurements.

Upon the conclusion of this subject, a number of resolutions and reports emanating from the earlier work of the various committees were laid before the Conference and after discussion, adopted.

These resolutions dealt with the following points:—

(i) The organisation of work on School gardens.

(ii) The desirability or otherwise of prescribing a "close" season in relation to rat destruction measures.

(iii) Various points in relation to the duties of sub-inspectors, especially in relation to the collection of statistics and other work.

(iv) The transport of Malay Officers on duty and monthly reports of subordinate officers.

In the course of the Chairman's concluding address, he stated that the Conference had covered a very wide field and expressed the view that when the results came to be examined, it would be found that a very great deal had actually been accomplished.

In the afternoon a number of the delegates visited the Government Experimental Plantation, Serdang.

The delegates foregathered in the evening at a Conference Dinner.

# CRABS IN PADI FIELDS.*

In North Kedah and Perlis, there occurs a small crab *Paratelphusa Sexpunctatum,* Lanceaster, which is found in large numbers in the padi fields and is very destructive to seedlings in the nurseries and also to those newly planted out. The crab appears to remain in the areas throughout the year, but does not breed rapidly or cause much injury to the padi plants except at the commencement of the season. It is a small, dark-brown species with a carapace (shell) when fully grown measuring from 1½ to 2 inches at the widest part and about 1½ inches long.

According to the Director of the Raffles Museum, the natural enemies of this crustacean are rats; the other (*Lutra leptonyx* Horsf.), king-fishers, some birds of prey and waterfowl. The peasantry in the Districts infested rely to some extent on ducks to keep the young of the pest in check; they also capture large numbers by hand. Poisons such as carbon bisulphide and calcium cyanamide have been placed in the small holes of the crab found in the bunds, but these, although effective, are far too expensive and dangerous to be placed in inexperienced hands.

In the Year Book of the Madras Department of Agriculture for 1927, there was published an article by K. Venkataraman which gives an account of the damage done by crabs in padi fields in Madras and also a description of experiments that were made in the endeavour to control them. The following is an extract from that article which applies equally well to local conditions.

> "Crabs cause serious damage to padi crops. They destroy sprouting seedlings in the nurseries with the result that there is a dearth of seedlings for transplanting, and they also cut down newly planted seedlings in the fields. The latter form of trouble often becomes serious, rendering it necessary to fill up gaps caused by the destruction of plants; this entails delay, additional worry, and an unnecessary reserve of seedlings. Crabs also make holes through the bunds of the fields, and, in one night, a field may be completely drained of water through the holes so made. In times of shortage of water, fields thus drained may not be refilled for several days, with the result that the crop is damaged. Where the pest is serious, coolies may have to be engaged to go round the bunds filling up the holes, and the expense of this is not inconsiderable.
>
> "It has been noticed that crabs find suitable conditions and do the greatest damage, only in fields which remain under water, They can be got rid of either by employing coolies to catch them by hand, or by setting up crab traps in the fields. The former method is costly and subject to the availability of labour; whilst the other is inexpensive,

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*Memorandum by W. N. Sands, Principal Agricultural Officer, Kedah.

simple, and self-acting. The following is a brief description of how to set up a crab-trap.

"A wide-mouthed ordinary mud-pot (chatty) is buried in a corner of the padi field so that the mouth of the pot is just flush with the level of the soil in the field. The mouth of the pot should be 4—6 inches wide and the pot itself about 12 inches in diameter at its widest part. The pot is baited with two handfuls of well-fried rice-bran moistened and made into large lumps for convenience in handling. In frying no oil is necessary, and the frying should be stopped when the bran becomes aromatic. If the whole field is under water, the pot also will fill with water; this, however, will not wash out the bait as wet bran quickly settles to the bottom of the pot. The smell of the rice-bran attracts the crabs which drop into the pot and are held captive there because the sloping convex neck of it effectively prevents all means of escape. The same bait may be allowed to remain in the pot for two days without detriment to the efficiency of the trap. Various other baits such as wheat-flour, powdered ground-nut cake, and fish-meal have been tried, but rice-bran gave the best results. Usually five or six crab-traps are enough for an acre plot, and these may be restricted with advantage to the vicinity of field bunds which harbour numerous crab-holes. Both the initial expense of the pots and the cost of renewing the bait are trifling. The crabs in the pots should be removed daily and destroyed."

In one District of Kedah where the damage done by crabs was so severe that whole fields of plants were completely destroyed, experiments were made following the lines of those described above. In one experiment five large pots, known to the Malays as 'buyong', were baited with rice-bran and sunk at intervals near to the bund of a field of about three-quarters of an acre in area in which newly planted padi had been totally destroyed. The result was as under.

| Date. | Pot 1. | Pot 2. | Pot 3. | Pot 4. | Pot 5. | Total Caught. |
|---|---|---|---|---|---|---|
| 28-8-30 | 21 | 18 | 21 | 25 | 35 | 120 |
| 29-8-30 | 15 | 30 | 35 | 28 | 15 | 123 |
| 30-8-30 | 1 | 9 | 11 | 2 | 2 | 25 |
| 31-8-30 | 4 | 6 | 6 | 4 | 18 | 38 |
| | | | | | Total = | 306 |

The pest was so reduced in numbers after four days that the pots were removed to another field for demonstration purposes. This field was about one acre in size and had also been badly damaged.

The results obtained here were as follows:—

| Date. | Pot 1. | Pot 2. | Pot 3. | Pot 4. | Pot 5. | Total Caught. |
|---|---|---|---|---|---|---|
| 1-9-30 | 5 | 12 | 19 | 27 | 10 | 73 |
| 2-9-30 | 4 | 23 | 6 | 5 | 12 | 50 |
| 3-9-30 | 5 | 10 | 12 | 11 | 6 | 44 |
| 4-9-30 | 3 | 5 | 10 | 7 | 5 | 30 |
| | | | | | Total = | 197 |

The fields were replanted in each case a few days later and no further noticeable damage resulted. In the latter case, however, the experiment was continued as invasions from neighbouring fields were to be anticipated, but the average number captured daily over a period of 10 further days was 6 per pot per day only.

It should be noted that a cracked or slightly damaged pot is just as effective as a good one and that the pots can usually be purchased at the pottery for a few cents only as against the cost of 20 to 25 cents for a sound utensil. Rice-bran is also obtainable locally in the shops at a cheap rate, namely, about 13 cents per gantang, whilst a certain quantity is obtained from siftings of home milled rice.

The trials already made with crab control in Kedah indicate that the species which occurs there can be readily and inexpensively kept in check by the use of large mud-pots, but in order to prevent damage the traps should be put lown in infested areas at the commencement of the season, that is, as soon as rain falls or the lands are irrigated.

# OBITUARY.

## Sir Francis Watts, K.C.M.G.

At the commencement of the Conference Session on November 1st the Chairman announced the death of Sir Francis Watts, K.C.M.G., late Principal of the Imperial College of Agriculture, Trinidad, which occurred on 27th September, 1930. He moved a resolution of regret on the occasion and of sympathy with the relatives of the deceased gentleman, referring to the services rendered by him to the cause of tropical agriculture during his long and distinguished career. The resolution was carried by the Conference standing.

The death of Sir Francis Watts removes one who was personally known to many in this Department. Those of us who have had the privilege of working with or under Sir Francis Watts regard him with great respect and affection. Officers of the Department of Agriculture, S.S. & F.M.S. feel that by his death not only does tropical agriculture lose a great figure but that many of us lose a personal friend, and almost all of us engaged in this science lose one who in one way or another has influenced their career and stimulated their work by his example and experience.

# Departmental.

## FROM THE DISTRICTS.

### The Weather.

There was an ample and well distributed rainfall in all parts of the country throughout the month.

### Remarks on Crops.

*Rubber.*—The price of rubber remained much the same as in the previous month; smoked sheet from small holdings sold for $10 to $17 and unsmoked sheet from $8 to $15.50 a picul. In Province Wellesley a number of holdings remained untapped while their owners were engaged in padi planting, since the primary importance of growing food supplies is now becoming more generally recognised. Wet weather and the continued low price have caused a further increase in the number of untapped small holdings.

The favourable damp conditions caused a recrudescence and spread of Mouldy Rot disease, as was anticipated; in most centres control measures have been well maintained. The occurrence of Oidium leaf fall in Province Wellesley was definitely recorded for the first time. Three estates experienced slight attacks at the beginning of the month, but the fungus disappeared when rainfall became heavy and continuous.

*Padi.*—Suitable weather caused a marked improvement in the growing padi throughout the country, even in areas previously affected by drought. It also enabled good progress to be made in localities where planting operations have only recently become possible. The general prospects of the season's padi crop are now considerably better than they were at the end of September.

Army worms appeared generally on the padi nurseries throughout Province Wellesley but were controlled by flooding or by the use of tuba solution.

*Food Crops.*—In Pahang West the Malay small-holders, perhaps as a result of past experience, grasped quite early in the year the importance of building up a good supply of food-stuffs to supplement their padi should the latter prove unsuccessful. In consequence, maize, tapioca and various vegetables have now been harvested and are available in abundance. New areas continue to be planted as fast as the old areas are harvested. In most mukims it would seem that the improved prospects of the padi crop, the extensive area of hill padi planted and the large supplies of maize and other food-stuffs available should secure the population against any serious shortage of food in the coming year.

In Negri Sembilan also the number of small vegetable plots planted in the holdings continued to increase and the demand for maize seed and tapioca cuttings was large; few Malay visitors to the Seremban Demonstration Station left without a large bundle of tapioca cuttings and a supply of maize seed of the popular Salisbury White variety.

### Notes on Demonstration Station and Padi Test Plots.

*Bukit Merah Test Plot, Province Wellesley.*—The quarters, store and office for the Padi Inspector have been completed and are now occupied; a permanent buffalo shed is in course of erection and a bridge and well are under construction. Transplanting of the padi from the nurseries is about to commence.

### Rat Destruction.

In Province Wellesley payments were made for 39,282 rat tails and 41,113 baits were distributed. In Krian 179,006 rats were destroyed. In each centre the rats accounted for since the commencement of the year now exceed 1,000,000. It has been decided to reduce the reward for tails from 1 to ½ cent each on and after the 1st of November.

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## DEPARTMENTAL NOTES.

### Visit of H.H. The Regent of Kedah to the Serdang Plantation.

H.H. The Regent of Kedah visited the Government Experimental Plantation, Serdang on 14th October, 1930.

### Visit of Mr. C. O. Oates to Malaya.

Mr. C. O. Oates, Agricultural Officer, Kenya Colony is on a visit to this Department. Mr. Oates will report to his Government on agricultural matters in this country and will forward a certain amount of plant material for trial in Kenya Colony.

### The Second Inter-Departmental Agricultural Conference.

An account of the Conference is included in this number. The Conference has given an opportunity for the officers of the Field Division to discuss various matters with the technical staff and has thus had a value apart from the actual Conference Sessions.

### Demonstrations to Chinese at Serdang.

A demonstration to Chinese Agriculturists was given at the Government Experimental Plantation, Serdang on October 8th, 1930.

### Leave.

Mr. F. S. Ward, Assistant Mycologist, returned from leave of absence on 3rd October, 1930.

# Statistical.

## MARKET PRICES.

### October 1930.

*Rubber.*—The market price of rubber appreciated slightly during the month. The lowest price recorded in Singapore was 11¼ cents per lb. on the first two days of the month, the highest price 14¼ cents on the 30th. The average price for the month in Singapore was 12.6 cents; in London 3.96d., compared with 12.8 cents and 4.09d. respectively in September.

*Palm Oil.*—On November 4th, London advised that the price of palm oil was on that date £16.17.6 C I.F. per ton on a basis of 18% F.F.A.

*Copra.*—Singapore copra prices showed some recovery towards the end of the month. Average October prices were: Sundried, $6.22, Mixed, $6.02 per picul compared with $6.57 and $6.39 in September. Copra cake averaged $1.90 against $2.13 in September. Market has advanced on improved demand and "short" covering. Supplies are moderate.

*Gambier.*—Singapore prices have remained steady at $9.37½ for block; $14.25 per picul for cube No. 1. Corresponding average prices in September were $9.70 and $14.35. Little demand, but supplies limited and prices remain steady.

*Nutmegs.*—Local prices for nutmegs show some improvement. 110's averaged $29.40; 80's $32.70 compared with $25 and $29.20 per picul in September. Market for nutmegs and mace firm due to an improved Continental demand and a shortage of supplies.

*Mace.*—A sharp rise is recorded in the Singapore prices during October. Siouw averaged $90.50, Amboina $67.50 per picul. The corresponding prices in September were $63.80 and $39.90.

*Pepper.*—Singapore average prices in October were: Black $24.80; White, Rio and Sarawak, $39.00; Muntok, white, $41.00 per picul. In September the corresponding prices were $21.45; $30.50; $31.40. Market steady with moderate business passing.

*Sago.*—Singapore average prices for October: Flake, small, fair, $6.19 per picul; Flour, Sarawak, fair, $2.99 against $6.22½ and $2.96 respectively in September. Reports at the end of October state that supplies are temporarily short and there is a good demand at higher prices for near delivery.

*Tapioca.*—October average prices in Singapore were:—Flake, small, fair, $4.24; Pearl, seed, $5.65; Pearl, medium $5.95. Corresponding prices for the previous month were respectively $4.13; $5.42½; $5.75. Latest report states that the market is fair with sellers inclined to hold off.

*Pineapples.*—Average prices in Singapore for October: 1½ lb. cubes, $3.40; 1½ lb. sliced, flat, $3.34; 1½ lb. sliced, tall, $3.76 per case. In Septem-

ber the average prices were $3.80; $3.68; $4.20 respectively. Demand moderate at very low prices.

The above market prices are based on the daily cabled London quotations and the Singapore quotations for rubber; on the Singapore Chamber of Commerce Market Reports from October 4th—November 1st, and on other local sources of information. Palm oil quotations are kindly supplied by Messrs. Lewis and Peat (S'pore) Ltd.

1 picul = 133 1/3 lbs.

The dollar is fixed at two shillings and four pence.

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## NOTE.

The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Planters of some of the minor agricultural products frequently experience difficulty in getting into touch with buyers. It is thought that in such cases the assistance of the department may be of particular value to producers.

# MALAYA RUBBER STATISTICS.

**Stocks of Rubber, including Latex, Concentrated Latex and Revertex held by Dealers and Estates of 100 Acres and over, the Declared Production of the same Estates, Imports and Exports, and the Estimated Production of Estates of less than 100 Acres, for the Month of September 1930, in Dry Tons.**

| Territory | Stocks at beginning of month | | | Production by estates of 100 acres and over | | Production by estates of less than 100 acres (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | during the month | | during the year 1930 | | during the month | | during the year 1930 | | | | |
| | Ports | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | Foreign | From Malay States | Foreign | From Malay States | Foreign | Local | Foreign | Local | Dealers | Estates of 100 acres and over | Ports |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **Malay States** | | | | | | | | | | | | | | | | | | |
| Federated Malay States ... ... | ... | 10,302 | 15,382 | 13,198 | 101630 | 10,078 | 84,947 | Nil | 5 | Nil | 52 | 16,384 | 6,028 | 137920 | 48,870 | 10,594 | 15,959 | ... |
| Johore ... ... | ... | 2,609 | 5,297 | 3,984 | 31,274 | 3,116 | 35,119 | Nil | Nil | Nil | 14 | 1,200 | 6,213 | 9,272 | 58,037 | 2,013 | 5,040 | ... |
| Kedah ... ... | ... | 475 | 2,387 | 2,233 | 17,240 | 946 | 10,941 | Nil | Nil | 30 | Nil | 1,056 | 2,341 | 6,676 | 21,624 | 436 | 2,208 | ... |
| Perlis ... ... | . | 7 | 8 | 7 | 74 | 5 | 114 | Nil | Nil | Nil | Nil | Nil | 9 | Nil | 202 | 10 | 8 | ... |
| Kelantan ... ... | ... | 144 | 108 | 363 | 2,285 | 304 | 3,384 | 1 | Nil | 31 | Nil | 79 | 501 | 628 | 5,091 | 182 | 158 | ... |
| Trengganu* ... | ... | 55 | 50 | 127 | 1,051 | 63 | 525 | Nil | Nil | Nil | Nil | Nil | 190 | Nil | 1,577 | 55 | 50 | ... |
| **Straits Settlements** | | | | | | | | | | | | | | | | | | |
| Malacca ... ... | ... | 2,461 | 1,951 | 1,330 | 10,648 | | | Nil | 2,906 | Nil | 15,592 | 4,626 | | 35,013 | | 2,606 | 1,957 | ... |
| Province Wellesley | ... | 145 | 702 | 567 | 4,054 | † | | | | | | | | | | 131 | 709 | ... |
| Dindings ... ... | ... | 117 | 191 | 101 | 882 | 3,260 | 30,131 | 381 | 3,303 | 6,863 | 30,083 | 5,961 | Nil | 50,244 | Nil | 89 | 145 | ... |
| Penang ... ... | 1,197 | 5,953 | 14 | 12 | 94 | | | | | | | | | | | 5,266 | 15 | 1,876 |
| Singapore ... | 4,680 | 32,637 | 340 | 250 | 2,054 | | | 6,296 | 9,068 | 81,519 | 89,660 | 20,677 | | 184,299 | | 28,526 | 324 | 4,954 |

**Analysis of Colony, Federated Malay States and Johore Dealers' Stocks at End of Month, in Dry Tons.**

| Class of Rubber (20) | Federated Malay States (21) | Singapore (22) | Penang (23) | Province Wellesley, Dindings and Malacca (24) | Johore (25) | Gross total (26) |
|---|---|---|---|---|---|---|
| Smoked sheet ... | 7,865 | 14,551 | 3,500 | 1,788 | 898 | 28,602 |
| Crepe ... ... | 518 | 12,328 | 1,203 | 700 | 240 | 14,989 |
| Unsmoked sheet ... | 1,195 | 1,647 | 563 | 338 | 511 | 5,634 |
| Scrap and lump ... | 1,016 | | | | 364 | |
| Total all Grades ... | 10,594 | 28,526 | 5,266 | 2,826 | 2,013 | 49,225 |

*Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated 17 Oct., (S. S. *Gazette* Not. No. 2111), being dry weight as estimated by Dealers themselves.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked Sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I. & E. 5, date October 3, (S. S. *Gazette* Not. No. 2054), foreign wet imports being reduced to dry weight by 25 per cent.

6. Foreign exports of each State and Settlement are those published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I. and E. 4, dated October 3, *Gazette* Not. No. 2053 Appendix IV to Monthly Trade Return).

*7. Stocks and production in Trengganu are estimated from figures supplied by the Commissioner of Lands.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.

†9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the Columns comprising it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

J. I. Miller, M.C.S.,
*Acting Registrar-General of Statistics, S.S. and F.M.S.*

Singapore, October 18, 1930.

## SUMMARY OF PAD REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS FOR THE MONTH OF SEPTEMBER, 1930.

| State | District | Acreage of padi land | Acreage planted | Percentage 4 to 3 | Gross crop | Crop per acre 6 to 4 | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | Gantangs | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Perak** | Perak North : | | | | | | |
| | Krian | 53,250 | ... | ... | ... | ... | About 16,000 acres planted clearing of land completed over all mukims, except Selinang and Gunong Semonggol where clearing has begun. |
| | Larut | 8,525 | ... | ... | ... | ... | About quarter of the area planted. Clearing completed over the rest. |
| | Selama | 3,450 | ... | ... | ... | ... | About two-thirds of the area planted Clearing complete. Planting nearly completed. Owing to lack of water padi tugal—not nurseries—has been planted in Bruas, Blanja, Layang, Boka, Lambor Kiri, and Kanan 6,900 acres. |
| | Kuala Kangsar | 13,977 | ... | ... | ... | ... | |
| | Upper Perak | 3,739 | ... | ... | ... | ... | Planting nearing completion. |
| | Perak South : | | | | | | |
| | Eight mukims | 14,817 | ... | ... | ... | ... | Clearing in progress. Areas in two more mukims have now been included. |
| | | 97,778 | ... | ... | ... | ... | |
| **Pahang** | West : | | | | | | |
| | Temerloh | 12,311 | ... | ... | ... | ... | 1 to 4 months planted. Flowering stage in some areas. |
| | Raub | 5,112 | ... | ... | ... | ... | Transplanting still in progress. |
| | Kuala Lipis | 8,450 | ... | ... | ... | ... | River mukims 1—4 months. Rest transplanting in progress. |
| | Bentong | 1,100 | ... | ... | ... | ... | Up to 2½ months old. { Acreage of padi land revised. |
| | | 26,973 | ... | ... | ... | ... | |
| **Negri Sembilan** | Seremban | 4,904 | ... | ... | ... | ... | Transplanting and weeding in progress. |
| | Kuala Pilah | 17,931 | ... | ... | ... | ... | Transplanting and weeding in progress. |
| | Port Dickson | 159 | ... | ... | ... | ... | Transplanting and weeding in progress. |
| | Jelebu | 3,116 | ... | ... | ... | ... | Transplanting completed. |
| | Tampin | 2,609 | ... | ... | ... | ... | Planting nearly finished excepting in Gemas and Tampin Tengah where planting has not yet commenced owing to lack of water. |
| | Rembau | 7,897 | ... | ... | ... | ... | Transplanting and weeding in progress. |
| | | 36,616 | ... | ... | ... | ... | |

## SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES AND STRAITS SETTLEMENTS, FOR THE MONTH OF SEPTEMBER, 1930.—(Continued).

| State or Settlement | District | Acreage of padi land | Acreage planted | Percentage 4 to 3 | Gross crop | Crop per acre 6 to 4 | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | Gantangs | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Selangor** | Ulu Langat | 2,670 | ... | ... | ... | ... | Transplanting completed. Water drained off in Kajang and Ulu Langat. |
| | Kuala Lumpur | 797 | ... | ... | ... | ... | Transplanting completed except in Sungei Buloh. Water drained off in Kuala Lumpur. |
| | Ulu Selangor | 1,205 | ... | ... | ... | ... | Transplanting completed. |
| | Kuala Selangor | 18,564 | ... | ... | ... | ... | Tanjong Karong and Sekenchau—694 acres—abandoned. Transplanting completed in Jeram 4710. Other mukims have not yet been visited. |
| | | 23,236 | ... | ... | ... | ... | |
| **Straits Settlements** | Malacca, Central | 16,473 | ... | ... | ... | ... | Planting almost completed. |
| | Alor Gajah | 11,136 | ... | ... | ... | ... | Planting almost completed. |
| | Jasin | 5,756 | ... | ... | ... | ... | Transplanting in progress. |
| | | 33,365 | ... | ... | .. | ... | |
| | P. Wellesley, North | 18,560 | ... | ... | ... | ... | Ploughing and planting in progress. |
| | Central | 10,519 | ... | ... | ... | ... | Clearing still in progress. All nurseries sown. |
| | South | 4,649 | .. | ... | ... | .. | Clearing still in progress. All nurseries sown. |
| | | 33,728 | ... | ... | ... | ... | |
| | Penang | 4,000 | ... | ... | ... | ... | Planting almost completed. |
| | Singapore | nil | ... | ... | ... | ... | |

**N.B.**—The figures given in the latest return under column 3 may be accepted as more accurate than any given in previous returns.

# METEOROLOGICAL SUMMARY, MALAYA. SEPTEMBER, 1930.

| Locality | Air Temperature in Degrees Fahrenheit | | | | | | | Earth Temperature | | Rainfall | | | | | | | | | Bright Sunshine | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Means of | | | Absolute Extremes | | | | | | Total | | Most in a day | Number of days | | | | | | | | | |
| | A. Max. | B. Min. | Mean of A and B | Highest Max. | Lowest Min. | Lowest Max. | Highest Min. | At 1 foot | At 4 feet | | | Amt. | Precipitation* | Precipitation, 1mm. or more | Thunder-storm | Thunder heard | Fog morning obs. | Gale force 8 or more | Total | Daily Mean | Per cent | Length of Day |
| | °F | °F | °F | °F | °F | °F | °F | °F | °F | in. | mm. | in. | | | | | | | hr. | hr. | % | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 91.5 | 71.7 | 81.6 | 96 | 69 | 83 | 74 | 83.3 | 83.9 | 5.12 | 130.1 | 1.68 | 12 | 8 | 1 | 10 | 2 | | 166.95 | 5.57 | 46 | 12.1 |
| Bukit Jeram, Selangor ... | 90.6 | 72.7 | 81.7 | 94 | 70 | 85 | 75 | 87.3 | 88.3 | 2.97 | 75.5 | 0.83 | 13 | 10 | ... | 14 | 9 | | 201.85 | 6.73 | 56 | 12.1 |
| Sitiawan, Perak ... | 90.4 | 71.7 | 81.1 | 93 | 67 | 86 | 74 | 84.3 | 84.5 | 5.33 | 135.4 | 1.25 | 13 | 11 | 7 | 14 | ... | | 195.60 | 6.52 | ... | ... |
| Kroh, Perak ... | 85.1 | 68.5 | 78.8 | 88 | 64 | 79 | 71 | 80.3 | 82.4 | 9.79 | 248.7 | 1.98 | 16 | 12 | ... | 6 | 2 | | 175.50 | 5.85 | ... | ... |
| Temerloh, Pahang ... | 91.3 | 72.1 | 81.7 | 95 | 69 | 86 | 75 | 85.5 | 86.4 | 3.89 | 98.8 | 1.41 | 13 | 10 | 4 | 18 | 5 | | 178.70 | 5.96 | 49 | 12.1 |
| Kuala Lipis, Pahang .. | 90.2 | 71.4 | 80.8 | 94 | 69 | 87 | 74 | 84.5 | 84.5 | 3.22 | 81.8 | 1.38 | 11 | 8 | 12 | 20 | 21 | | 173.45 | 5.78 | ... | ... |
| Kuala Pahang, Pahang ... | 87.8 | 73.8 | 80.8 | 92 | 72 | 85 | 77 | 86.6 | 88.0 | 3.95 | 100.3 | 1.23 | 14 | 13 | 15 | 18 | ... | | 223.50 | 7.45 | 62 | 12.1 |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 71.7 | 59.0 | 65.3 | 79 | 57 | 64 | 61 | ... | ... | 11.79 | 299.5 | 3.72 | 19 | 15 | 3 | 11 | 1 | | 161.70 | 5.39 | 45 | 12.1 |
| Cameron's Highlands, Tanah Rata | 72.3 | 55.2 | 63.7 | 76 | 46 | 66 | 61 | 70.2 | 69.8 | 10.60 | 269.2 | 2.84 | 16 | 15 | 3 | 13 | ... | | 156.55 | 5.22 | 43 | 12.1 |
| Fraser's Hill, Pahang ... | 74.3 | 61.9 | 68.1 | 79 | 60 | 70 | 63 | 70.9 | 71.6 | 7.09 | 180.1 | 2.42 | 13 | 12 | .. | 7 | 8 | | 169.30 | 5.64 | 47 | 12.1 |
| Mount Faber, Singapore ... | 87.6 | 75.4 | 81.5 | 92 | 71 | 81 | 79 | 83.3 | 84.4 | 8.76 | 222.5 | 3.40 | 12 | 9 | 1 | 15 | .. | | 164.40 | 5.48 | 45 | 12.1 |
| Butterworth, Province Wellesley | 87.3 | 73.3 | 80.3 | 91 | 70 | 81 | 75 | 85.1 | 85.2 | 12.03 | 305.6 | 2.49 | 18 | 16 | 1 | 9 | ... | | 187.55 | 6.25 | ... | ... |
| Bukit China, Malacca ... | 84.8 | 73.2 | 79.0 | 87 | 71 | 82 | 76 | 83.6 | 84.8 | 9.95 | 252.5 | 1.90 | 22 | 18 | 2 | 4 | ... | 1 | 198.00 | 6.60 | 55 | 12.1 |
| Kluang, Johore ... | 88.2 | 71.0 | 79.6 | 93 | 69 | 81 | 74 | 81.5 | 82.3 | 6.41 | 162.8 | 1.70 | 17 | 15 | 1 | 9 | 7 | | 152.20 | 5.07 | 42 | 12.1 |
| Bukit Lalang, Mersing, Johore... | 89.4 | 72.1 | 80.7 | 93 | 70 | 80 | 75 | 82.3 | 82.6 | 3.09 | 78.5 | 1.17 | 17 | 13 | 4 | 22 | 1 | | 183.40 | 6.11 | 55 | 12.1 |
| Alor Star, Kedah ... | 86.7 | 73.8 | 80.3 | 90 | 71 | 77 | 77 | 85.1 | 86.0 | 9.41 | 239.0 | 2.58 | 17 | 15 | ... | 2 | ... | | 174.40 | 5.81 | ... | ... |
| Kota Bharu, Kelantan ... | 89.0 | 73.3 | 81.1 | 91 | 70 | 87 | 75 | 85.3 | 85.5 | 6.67 | 169.4 | 1.24 | 16 | 13 | ... | 12 | ... | | 186.85 | 6.23 | ... | ... |
| Kuala Trengganu, Trengganu... | 88.7 | 73.1 | 80.9 | 92 | 71 | 86 | 75 | 84.4 | 84.9 | 4.67 | 113.9 | 1.82 | 15 | 10 | 1 | 17 | 1 | | 210.95 | 7.03 | ... | ... |

* Precipitation ·01 inch or more when measurement is in inches ·2mm. or more when measurement is in millimetres.

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

# Malayan Agricultural Journal.

Vol. XVIII. DECEMBER, 1930. No. 12.

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The Plant Physiologist.
The Agricultural Economist.
The Agricultural Chemist.
The Entomologist.
The Chief Agricultural Field Officer.
The Assistant Chemist for Copra Investigations (Secretary).

## ERRATA.

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Malayan Agricultural Journal. Vol. XVIII, No. 7, July, 1930.

**Page 343, Paragraph 5, line 5** should read as follows:—

"....................1,000,000 tons of copra equivalent to 5,000,000,000 nuts".

**Page 346, line 12**

for 1176 substitute 1776.

THE

# Malayan Agricultural Journal

DECEMBER, 1930.

## EDITORIAL.

**Padi Estates.** The pages of the *Malayan Agricultural* Journal have frequently been used to record different aspects of padi cultivation and it may perhaps be thought that undue emphasis has been laid on a crop considered more suited to cultivation on a small scale and therefore not of particular interest to the majority of the readers of this Journal. The reason for the public indifference to padi cultivation has, we suspect, been mainly because the crop does not appear to offer any promise of substantial profits. The position has of late been somewhat clarified, and two important points emerge. Firstly, the population of Malaya cannot stand aloof from the importance of maintaining an adequate food supply for the imported labour; and secondly, the employment of capital in the cultivation of padi on a large scale is daily entering more surely into the sphere of practical planting politics.

In the past this Department has given considerable attention to the improvement of varieties of padi and the control of pests and diseases of the crop: this experience will be of considerable value when the time comes—as we think it will—for a more general appreciation of the value of padi as a crop for cultivation on a large scale.

In a previous article appearing in this Journal, attention was drawn to the successful cultivation of padi on a large scale in Australia and it was pointed out editorially that a similar system has been established in certain other countries. In an article which appears in this number under the title of "Mechanised Rice Cultivation in Southern Siam", the argument in favour of large scale padi cultivation is brought a step nearer home. The successful enterprise of a Penang Chinese family in establishing a rice plantation in South Siam is particularly noteworthy. The argument that this crop is more suited to cultivation by Asiatics than by Europeans is refuted by the fact that these pioneers achieved success, not by their innate knowledge of the crop, but by the adoption of western methods of cultivation.

**The Future of Coconuts.** The ever-increasing demand for vegetable oils will lead those concerned in production to consider possible future developments in the cultivation of coconuts. The present set-back in prices is no indication of future demand and it is pro-

bable that copra will for many years be able to compete with other edible vegetable oils. But in order that the industry may be in this favourable position it is essential that the cost of production be materially reduced, and this to our mind can best be effected by the elimination of poor yielding trees. Amongst other factors that require reviewing are drainage and the possible abandonment of unsuitable areas.

It appears to have been the practice in the past to regard all coastal areas as suitable for coconut cultivation and all inland areas as unsuitable. Recent investigations shew that the soils on the coastal flats vary considerably and certainly include areas that are unsuited to coconuts: on the other hand, there is no conclusive evidence that inland soils are necessarily unsuitable for coconuts.

As the country becomes developed, the choice of sites for extensions of the area under coconuts becomes narrowed, so that any evidence that can be adduced regarding the suitability of definite types of soil are of value. The article in this number on Coconuts on Peat, by Mr. F. C. Cooke should therefore prove useful for those who are considering the employment of reserve areas on their estates or who contemplate extensions in new areas.

**The Malayan Agricultural Journal.** The present is the final number of Volume XVIII of the *Malayan Agricultural Journal*. Judging by the expressions of approval that have come to our ears, the public of Malaya appreciates the changes in the Journal which were effected at the commencement of the year. The steady increase in circulation is gratifying, but there are still many engaged in agriculture in Malaya who do not regularly read the Journal and we cannot rest satisfied until this publication finds its way to every estate in the country.

Publications are the chief means whereby the results obtained by research work—in the laboratory and the field—can be conveyed to the planter. In addition to the articles which embody the results of research work, the Journal has two further functions, viz: by means of articles and statistics to give a true perspective of the agricultural conditions obtaining in Malaya, and by means of selected articles, abstracts and reviews to bring to the notice of readers the results of research work in other countries that have a bearing on Malayan agriculture.

Planters are perhaps prone to disregard agricultural publications because of their multiplicity. The publication of several agricultural journals in one country is apt to confuse, and it generally results in much important information not reaching the readers for whom it was intended. In order in some measure to obviate such confusion, agreement has been reached between the Rubber Research Institute of Malaya and ourselves concerning the publications of the two departments. The Quarterly Journal of the Rubber Research Institute of Malaya will cease publication at the end of 1930 and all articles of a general nature concerning rubber, prepared by the Institute, will thereafter be published in the *Malayan Agricultural Journal*. The results of research

work performed by the Institute will be published by that body in a journal at irregular intervals as subject matter becomes available. It is anticipated that this arrangement will widen the scope of the *Malayan Agricultural Journal* and thus render it more useful to agriculturists in Malaya.

**Special Bulletins.** The Department of Agriculture has published during 1930 a number of Special Bulletins. Some of these have been of a technical nature likely to interest the scientist rather than the practical planter. But at least four of the eight Special Bulletins are of a description that should interest agriculturists.

The programme of Special Bulletins for 1931 is an ambitious one. It includes the following three publications:—

*Tapioca in Malaya*— the result of several years of research work.

*Insects of Coconuts*— giving a complete account of the insects—both beneficial and harmful—that are associated with coconuts. This publication should prove of great value as a book of reference for coconut planters.

*The Oil Palm in Malaya*—Bulletin No. 39 on this subject, published in 1927 is nearly out of print. This publication is therefore being carefully revised and brought up to date by the inclusion of valuable material that has since become available.

It is hoped that all those concerned with agriculture in Malaya will make a point of including the publications of this Department on their book-shelves during the coming year.

# MECHANISED RICE CULTIVATION IN SOUTHERN SIAM

BY

H. A. TEMPANY,
*Director of Agriculture,*

H. W. JACK,
*Economic Botanist*

and

W. N. SANDS,
*Acting Principal Agricultural Officer, Kedah.*

In connection with the work of the Rice Cultivation Committee, the writers visited the plantation of Messrs. Chin Leong & Co., in the Patalung District of Southern Siam. For some years past Messrs. Chin Leong & Co., have grown rice on a large scale by means of tractors, ploughs, harrows and modern harvesting machinery. The members of this firm, namely Yap Hoon Teng, Yap Hoon Hock, Yap Hoon Teong and Yap Hoon Bee, are Straits-born Chinese who have their headquarters in Penang and branches in Medan, Batavia and Haad Yai. Among other things, the firm imports agricultural implements and fertilisers and it was with a view to the extension of these that it first undertook this form of cultivation.

## Description of Land.

For the purpose, in 1926 the firm obtained a concession from the Siamese Government of 2,600 acres of land in the Patalung District of Southern Siam. Land had previously been applied for in Kedah, but was not obtained. The land obtained is more or less open country comprising grass land with scattered clumps of small trees. The soil appears to be fairly suited for padi cultivation but it cannot be described as first class padi land since it is rather light in texture although the subsoil consists of heavy alluvial clay, suitable for retention of water.

The property is situated some 50 miles north of Haad Yai and about 4 or 5 miles west of the inland sea. Water is available from a small river which flows along the margin of the property and the owners have erected a small dam for the purpose of diverting water on to the land and have also installed pumping machinery. At the time of this visit about 600 acres were already planted with padi.

## Machinery.

During the time the Company has been operating this property the owners have made every endeavour to ascertain the most satisfactory implements for

Kimball 12 inch Turbine Pump, driven by 12/20 Case Tractor.

Irrigation Canal.

CASE TRACTOR (18—32) PULLING 8 FT. BINDER.

10 FOOT SEED DRILLER AND FERTILISER PULLED BY 12/20 CASE TRACTOR.

undertaking padi cultivation on a large scale. They have also established a very satisfactory system of canals and distributaries for irrigation and are now in a position to control the supply of water with great facility. They have imported six Case tractors of which three are 18/32 H.P. type and three are 12/20 H.P. type tractors. For cultivating the land they have imported and experimented with a considerable selection of ploughs and harrows and have come to the conclusion that for breaking up the new land disc ploughs are preferable. Of these, various types have been tried, the most satisfactory so far found being the Wheatland plough made by J. I. Case & Co. of Wisconsin. This is a new form of plough, the principal feature of which is that it is made either with a 6 or 8 foot cut and respectively provided with 10 or 13 discs fitted vertically on to a spindle which is staggered at an angle of about 45° in relation to the line of draft of the plough. It is stated that this plough gives more satisfactory results than the older and more conventional designs of disc ploughs of which they also possess examples.

For land that has already been in cultivation, in order to turn in the stubble and weeds it has been found that ploughs of the mould board type are preferable and for this purpose three gang mould board ploughs of the type usually worked with tractors and of which the depths of ploughing can be regulated in the usual way are employed.

## Cultural Operations.

In preparing land for ploughing, the usual practice is to plough the land once or twice—the number of times depending on the condition of the land—to a depth of 4 or 5 inches and then to follow this by harrowing with a double disc harrow and finally by levelling the surface by means of a float or drag, consisting of two heavy planks lapped and bolted together. It is stated that three 12/20 h.p. tractors can handle 600 acres of land, including the preparation of the land and sowing the seed, in 60 working days of 10 hours, or at the rate of 10 acres per day.

Sowing directly into the fields is accomplished by means of mechanical drills of which two types are employed; one being a 10 foot combination seed and fertiliser drill and the other a broadcaster which is preceded by a fertiliser spreader. It is followed by a harrow. The seeding machines employed are the Peoria Combined Grain Drill and Fertiliser Spreader and the Endgate Broadcaster. It is stated that cultivation and seeding operations have to be carefully watched in relation to the degree of moisture content of the land, satisfactory results only being obtained within rather narrow limits of soil moisture content. Experience has shown that by working at suitable seasons and by regulating the moisture supply to the land by means of irrigation water, little difficulty normally exists in preparing and sowing the land. The writers were unable to see the tractors working owing to the fact that recently there had been heavy rain, but the work done was inspected in its various stages and it was seen that the operations produce a tilth which is eminently suitable for rice cultivation.

It may be added that, in relation to methods of sowing the seed, the drill results in a more regular stand than does broadcasting, but on the other hand, where time is an object, broadcasting is much more rapid.

### Manuring.

Regular manuring of the land is practised and in this connection numerous fertilisers have been tried including ankerphos, plutophos, ammophos, nitrophoska and leunaphos. The owners have no definite information as to the fertiliser that gives the best result, but they appear to prefer ankerphos. It is doubtful whether, in the early stages of development of the land, fertilisers can have much effect in view of the fact that the land cannot have been under cultivation for a long period, although at a later date, benefit will doubtless accrue from the application of these fertilisers. It is understood that in due course the proprietors will carry out properly designed experiments to test the efficiency of fertilisers.

### Water Supply.

Considerable importance attaches to the manner in which water is led on to the land after sowing. The procedure adopted is to irrigate the land sufficiently to make for a slightly damp condition until the seed has germinated and the crop has grown to a height of about 10-12 inches; the plots are then gradually flooded. There appears to be no shortage of water at the present time and the water control arrangements are admirably devised.

As stated previously, water is obtained by means of a dam on the river which also diverts the water into a conduit from which it is pumped to the fields. The pumping is performed by means of a Kimball 12 inch turbine pump with a lift of 6 feet and a discharge capacity of 3,000 gallons per minute. The pump, which costs approximately $2,000/- is driven by a belt from a 12/20 h.p. Case Tractor which consumes one gallon of lubricating oil and three tins of kerosine per 12 hour day. The pump appears to require the minimum of attention and is stated to give general satisfaction. For digging ditches for irrigation, a Martin ditcher is employed which is hauled by a Case tractor.

### Harvesting.

Harvesting is accomplished by means of harvesting machinery. The owners have imported two McCormick twine binders each with 8 ft. cut, and a Case thresher. In learning to operate these they were assisted by a representative of J. I. Case & Co. who came from India specially to start the work. As an alternative method of harvesting they very recently imported a Sunshine Header harvester with a 6 ft. cut. This is a new type of machine which has found application in padi cultivation in Australia. It combines in one machine the three operations of harvesting, threshing and winnowing. It is stated by the owners that one of the difficulties experienced is the uneven ripening of the grain owing to the employment of local mixed seed and the suggestion was

made that greatly improved results should accrue from the use of pure strains which give a stand of uniform height and which ripen uniformly.

It is stated that average yields of 450 gantangs of padi per acre are being obtained and that the scheme is profitable. The following data have been obtained as to costs on new land:—

| | | | |
|---|---|---|---|
| Ploughing and harrowing | ... ... | \$6.60 | per acre. |
| Manuring and sowing | ... ... | \$1.25—\$2.00 | ,, ,, |
| Total cost of preparation of new land | ... | \$8.00—\$8.50 | ,, ,, |

As far as can be ascertained, the cost of pumping water to the land works out at about \$3.50 per acre; no data were available regarding the cost of harvesting.

The demonstrations that have been given by these Chinese gentlemen are of the utmost importance as they definitely settle a point that has been argued on many occasions, namely, whether or not the mechanical methods of cultivating rice which have been successfully developed in California, the Southern States of America and in Australia are applicable in the Eastern Tropics. The answer is definitely in the affirmative. Figures are not available to show the whole cost of the operations of planting and harvesting the crop, but calculations made by the Department of Agriculture indicate that the cost including supervision would probably be in the region of \$20/- per acre. At this rate and with an average market price for padi of 13 cents per gantang, a very reasonable margin of profit may be expected from operations of this description.

# COCONUTS ON PEAT

BY

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Considerable doubt exists as to the suitability of "peat" and "organic" soils for coconuts. In many cases the young palms thrive remarkably well, but there are indications that under certain conditions this early promise may not be fulfilled. Sampson[1] roundly condemns such soils; there is, however, doubt as to whether this condemnation is rightly directed to the soil rather than to the lack of provision of proper drainage as understood and practised in Malaya.

As there is confusion in the use of the term "peat" which is loosely applied in this country to any soil which contains notable quantities of organic matter, it is advisable to define what is really meant in these notes by "peat" and "organic" soils respectively.

*Peat.*—The word "peat" is taken to indicate a soil which consists of compact coherent masses of plant residues. Three different types of peat are generally recognised, differentiation being made according to the nature of the original plants:—(1) Moor (high moor or upland peat) formed from mosses, (2) Fen peat, formed by the decay of reeds and similar aquatic plants and (3) Carr or wood peat formed chiefly from trees.[2]

The coastal peats of Malaya appear to belong to the Fen and Carr formations. The peats are found lying between the true coastal alluvium and the inland quartzite formation. When the underlying soil is reached it is usually found to be intermediate in properties between the coastal alluvium and inland soils generally quartzite.

It seems highly probable that a ridge of coastal alluvium was built up in the region of the present sea-board giving rise to swamp or lagoon conditions between itself and the quartzite. Gradually a clay bed was laid down in the lagoon by erosion of the higher lying quartzite with the formation of Fen conditions, i.e. with growth of Cyperaceae (reeds and sedges) which by their decay gradually raised the ground level. This, in the course of time, became covered by forest and forest litter.

At the junction of the original swamp with the alluvium and inland soil respectively, a thorough admixture of decaying vegetation and mineral soil is usually to be found in belts of varying width and depth (the latter from a few inches to four feet) overlying a stiff clay in the former, and a soil of inland type in the latter case. Such soils are very frequently referred to as "peats"

(1) The Coconut Palm—Sampson, H. C.

(2) Evolution and classification of soils—Rahmann, E. Page 74 and seq.

although the name is in this case a misnomer—it is preferable to refer to them as "organic" soils.

The true peat is distinct, usually red brown to red black in colour, fibrous and containing very little mineral matter; it has a very acid reaction and on too deep or too rapid draining crumbles to a dry powder which it is almost impossible to reconvert into its original fibrous condition.

Apart from appearance and texture, the degree of "peatiness" of a soil can readily be determined by burning and weighing the residue—the amount lost expressed as a percentage of the dry soil is the familiar "loss on ignition" of soil analyses. "True peats" show loss on ignition exceeding 80 per cent. while "organic" soils show losses varying from 15 to 80 per cent.

An extensive tour has been made of the main peat areas of Malaya, in order to make observations on coconuts growing on true peats.

## Description of the Areas Visited.

Four main types of peat formation have been inspected:—

SOUTH CENTRAL MALAYA.

(a) A larger inland area where the peat is woody, fibrous, of great depth and very water-logged.

(b) An adjacent area where the peat is of the same type, but while generally deeper than eight feet, is not such a thick formation as the previous area, nor is the water level as high.

(c) Two narrow tongues of peat of no great depth or breadth running from the inland areas towards the sea.

SOUTHERN MALAYA.

(d) An extensive peat area near the sea, of varying thickness and ranging from black earthy peat to a fibrous woody mould which dries to a crumbling powder. The whole of this area has underlying it the heavy clay characteristic of the majority of Malayan coconut areas.

NORTH CENTRAL MALAYA.

(e) A river of peat with a thin top soil of grey clay.

## South Central Malaya.

A new trunk road is in course of construction through the vast peat swamps (a) and (b) which are some 12 miles from the sea and which are adjacent but separated by a large hill or island of light sandy clay. As already explained, these areas lie between the quartzite of the interior and the alluvial clay of the coastal plains. A community of Javanese immigrants has settled here and cleared over 10,000 acres of virgin jungle. Area (a) is already practically abandoned because the settlers have been unable to cope with the high table of rapidly moving water which is found close to the surface of the soil

in spite of frequent well-made cross drains and excellent main drainage. Work on area (b) is progressing and while the young palms are developing, an extensive range of catch crops appear to be thriving well.

The thickness of the peat in area (b) is considerable and at one point it is said to be about 15 feet. The peat in area (a) is even of greater depth and actual borings gave at two different points 36 feet and 44 feet respectively. While area (a) is water-logged, the water table is not reached in area (b) until between 2 and 3 feet. The presence of raised paths, however, is evidence that this area is also liable to floods. It would appear that the formation consists of two extensive lakes of peat filling the valleys between foothills of light sandy clay which are dammed by the alluvial coastal ridge.

*Drainage, Cultivation and Yield.*—Two well-made drains 10 feet wide flank each side of the main trunk road and cross drains are being constructed at approximately 50 yard intervals (1 per 5 rows), at right angles to the main drains as the palms mature.

None of the palms are in bearing, the oldest being 4 and 5 years. The most interesting feature of the district is the amount and variety of catch crops which are being grown extensively by the Javanese settlers.

Pineapples of the "Queen" type seem to be in particular favour and a considerable number of Sarawak pines are also to be seen; the remaining catch crops are as follows:—coffee, papaya, bananas, caladium, maize, bread fruit, sweet potatoes, tapioca and pumpkins.

Except among the older palms where pineapples are grown almost exclusively and in well ordered rows, the various catch crops are found promiscuously among the young palms and the rotting remains of large jungle trees.

The soil is very resilient and while the top six inches is particularly coarse, woody and fibrous, lower down the peat is decomposed, mushy and of a dark red brown colour. It contains very little inorganic matter as is shewn by the loss on ignition 95-99 per cent. The soil drys to a sawdust-like powder.

The soil samples Nos. 1, 2 and 3 were taken each a mile apart, from the middle of area (b), sample No. 3 being nearest the "island" of sandy clay and taken among the oldest palms. The analytical results are practically identical, and as one would expect, the soils are very acid, while sample No. 3 from the deepest peat is completely burnt away on ignition.

The development of the palms in areas 1 and 2 is very irregular and a few of the young seedlings are conspicuously weak and ill-developed while others are progressing quite well. In the youngest area (sample No. 1) the foliage of the one year old palms is inclined to be yellow and the jungle remains and assorted catch crops appearing at random give the area a somewhat neglected appearance. Sample No. 2 was taken from an area where the palms are two years old and where the ground has been practically cleared of jungle refuse. Here the settlers' houses are of more permanent construction and the various catch crops are being cultivated in a careful and orderly manner, while the palms are in fair condition. Sample No. 3 was taken from

A Top-heavy Good Yielding Palm Growing on Peat.

Coconuts Growing on Peat.

an area approaching the bearing stage where the palms are of even height, between 18 and 20 feet. The fronds of the palms are distinctly yellow in colour and covered with scale, but the catch crop of pineapples is growing well.

The method of planting practised by these Javanese settlers is of interest because it allows for the shrinkage of the soil when the drainage is extended and the water table drops. A hole is dug some 18 inches deep and the germinated seed nut is placed in the bottom and just covered with the original loose top soil leaving the shoot exposed while the remaining soil is mounded round the hole. In the heavy clays of typical Malayan coconut areas, this practice might lead to a rotting of the stem of the young palm by rain water which would collect in the hole, but in peaty soils, water can drain away. It is understood that a similar method of planting is adopted in the light soils of the Philippines to prevent "stilting" and tree-fall and to encourage the growth of a sturdy trunk.

*Coastal Area* (c).—Heavy alluvial clay is mainly to be seen along the main road which runs close to and parallel with the sea, but in one or two places peat occurs. These peat formations take the form of narrow tongues stretching from the main inland areas (a) and (b) to the sea. It is thus possible to compare mature palms growing on peat with similar palms on the heavy clay typical of Malayan coconut areas and to observe that the former are neither so healthy nor so productive as the latter.

*Drainage, Cultivation and Yield.*—District (c) while mainly heavy clay, contains one or two peat areas and is all of native planting. The palms are all bearing and those on clay are generally yielding between 30 and 40 nuts per tree except where palms have been planted in salty coastal swamp in which case no nuts are being produced. On the other hand, the palms on the peat are not of healthy appearance. There are frequent gaps in the planting probably because of palm-fall or disease; the palms are shorter than those adjacent; the trunks are less sturdy; the boles are exposed to a height of over two feet; the average yield per palm would appear to be less than 20 nuts per annum and the nuts are small in size.

Occasionally, a palm estimated to produce 50 nuts per annum is to be seen, but against there are very many non-yielders.

Soil sample No. 4 was taken from a small holding and sample No. 5 was taken from a large native plantation where the grass and fern is allowed to grow as a cover, being kept well slashed, and where good drainage is practised.

## Southern Malaya.

This district proved particularly interesting because a variety of conditions was met with in the same extensive peat area on a European estate while palms of ages ranging from 2 to 30 years old could be inspected.

The areas sampled were as follows:—

No. 6. Peat 3½ feet thick with underlying clay—poor yielding mature palms.

No. 7. Peat more than 4 feet thick—boggy and overgrown—bad yielding mature palms.

No. 8. Peat 2 feet thick with underlying clay—high yielding young palms.

No. 9. Peat of unknown thickness—seedlings in good condition.

No. 10. Peat $4\frac{1}{2}$ feet thick with underlying clay—fair yielding mature palms.

*Drainage, Cultivation and Yields. Area No. 6.* The palms in this area are said to be 20 years old and are estimated to yield less than 40 small nuts per annum in spite of regular cultivation and good drainage. The land is very low lying and the water table at the time of visiting was about one foot from the surface although drains are laid every third row. The cover is the reddish sedge indicative of an acid condition of the soil which is wet, black and weathered to a homogeneous mass. No tree fall has occurred although water-logging is of frequent occurrence and soil shrinkage amounting to two feet has taken place. This is because the trees are not tall and because they are low yielders. The underlying soil is reached at 3 feet 6 inches and consists of light grey heavy clay.

*Area No. 7.*—In this area the palms are said to be 20 years of age but, because the soil is so continuously water logged, the palms are short, their trunks are thin and the nuts are few and small. The conditions being so unfavourable it is not considered worth while to do more than an occasional slashing back and at the time of the visit the land was considerably overgrown with fern and other heavy weeds.

Between Areas 6 and 7, intermediate conditions exist. The area is cultivated regularly, but the palms are stunted and are poor yielders while occasional gaps occur. In the adjacent native holdings, similar water-logged conditions exist. The palms are very poor yielders and are crowded out by areca palms and close grown pineapples.

*Area No. 8.*—This area is undoubtedly the best in the whole of the peat districts visited. The palms are seven years old, and although only 20 feet in height and having sturdy trunks, they are already beginning to lean, because of the spread of the crown and the weight of nuts. The peat is more earthy than any previously mentioned, probably because it is only two feet in thickness.

The palms bear between 40 and 100 nuts and average about 60 medium sized nuts per annum. Few cross drains have yet been dug. The cover is obtained by selective weeding leaving low fern which is growing very thickly.

*Area No. 9.*—The soil and general conditions appear to be similar to those of the driest parts of the peat areas (a) and (b). The peat is also very woody and fibrous and of recent origin and its depth, which is unknown, is definitely greater than six feet.

This area was opened up just over two years ago. It is now clean weeded, very well kept and traversed by well made drains and cross drains; the latter are laid every twenty rows. Because this soil is liable to dry, the cross drains are allowed to silt up to retain the moisture in the soil. The soil is more

## Comparative Records of Coconut Palms Growing on Peat in South Central Malaya.

| — | Abandoned (a) | 3rd Mile (b) No. 1 | 2nd Mile (b) No. 2 | 1st Mile (b) No. 3 | Inland (c) No. 4 | Coastal (c) No. 5 |
|---|---|---|---|---|---|---|
| Loss on ignition of dried soil | ... | 95 | 95 | 99 | 74 | 96 |
| Acidity (pH unfiltered) - | ... | 4.2 | 4.2 | 4,2 | 4.0 | 3.5 |
| (pH filtered) - | ... | 5.4 | 5.2 | 5.4 | 5.2 | 5.2 |
| Age of palms—estimated - | various | 1 = 1½ years | 2 years | 4-4½ years | 25-30 years | say 25 years |
| Condition of palms | bad | variable | variable | much scale insect | good tall medium | poor medium |
| Size of nuts - - | ... | ... | ... | | | small |
| Estimated yield per tree annum - | ... | ... | ... | few nuts or none | av. 20 (Max. 50) | av. 20 (Max. 50) |
| Method of planting - | ... | Javanese sunken hole | Javanese sunken hole | Javanese sunken hole | Native | Native |
| Drainage—cross drains - | 1 in 5 rows | very few | very few | very few | ... | occasional |
| Water table (at time of visit) | 6 ft. | 2 ft. | 2 ft. | 2 ft. 6 in. | 2 ft. 3 in. | 3 ft. 6 in. |
| Cover - - | ... | ... | ... | ... | clean | grass & fern |
| Catch crops - - | ... | various | various | almost wholly pine apple | ... | some arecanut palms |
| Description of peat | dark brown | Fibrous slimy red brown | fibrous slimy red brown | slimy red brown | black humus | red brown |
| Depth - - | 26ft. to 42ft. | 8 ft. | unknown | said to be 15 ft. | more than 6 ft. | more than 6 ft. |
| Moist or dry - | ... | moist | moist | moist | damp | damp |
| Shrinkage or tree fall - | ... | ... | ... | tree fall 1 in 4 | 1 ft. 6 in. shrinkage. | 2 ft. shrinkage no tree fall |
| Underlying soil - | ... | probably light sandy clay | probably light sandy clay | probably sandy clay | ... | probably sandy clay |

COMPARATIVE RECORDS OF COCONUT PALMS GROWING ON PEAT IN SOUTHERN MALAYA UNDER ESTATES CONDITIONS.

| — | Area No. 6. (d) | Area No. 7. (d) | Area No. 8. (d) | Area No. 9. (d) | Area No. 10. (d) |
|---|---|---|---|---|---|
| Loss on ignition of dried soil | 95 | 83 | 62 | 95 | 94 |
| (pH unfiltered) | 3.8 | 4.3 | 4.0 | 4.2 | 3.7 |
| Acidity (pH filtered) | 5.2 | 5.2 | 5.2 | 5.0 | 5.0 |
| Age of Palms—estimated | say 20 years | say 20 years | say 7 years | $2\frac{1}{4}$ years | 25—30 years |
| Condition of palms | fair | poor | fairly good | good | good |
| (Height) | medium | short | ... | ... | tall |
| Size of nuts | small | small | medium | ... | small |
| Estimated yield per tree per annum | 40 | av. 10 | av. 60 (max. 100) | ... | 45—50 |
| Method of planting | Native planted | Native planted | European planted | European planted | Native planted |
| Drainage—cross drains | 1 in 3 rows | 1 in 5 rows | very few | 1 in 20 rows | 1 in 6 rows |
| Water table (at time of visit) | 1 ft. | Less than 1 ft. | 1 ft. | 1 ft. 6 ins. | 2 ft. |
| Cover | peat grass | overgrown | fern | none | fern and peat grass |
| Catch crops | ... (Areca palms and pineapple native holdings adjacent) | ... (Areca palms and pineapple on native holdings adjacent) | ... | coffee (Areca palms and pineapple on native holdings adjacent) | ... |
| Description of peat | earthy brown dark | earthy black | earthy black | woody and brown | earthy dark brown |
| Depth | $3\frac{1}{2}$ ft. | more than 4 ft. | 2 ft. | unknown | $4\frac{1}{2}$ ft. |
| Moist or dry | moist | water-logged | wet | damp but dries to a powder | damp |
| Shrinkage or tree fall | 1 ft. shrinkage no tree fall | ... | tree fall in the future probable | ... | a little |
| Underlying soil | probably grey clay | probably grey clay | grey heavy clay | probably grey clay | grey heavy clay |

fibrous than elsewhere and is full of rotting wood. Coarse red sedge grows very readily and needs frequent removal.

The young palms are of healthy appearance and of even height. Coffee is to be grown later as a catch crop while on the adjacent native holding areca nut palms are being grown in the ratio of 4 areca to 1 coconut palm.

*Area No. 10.*—This area was originally of native planting. The palms, which are the tallest seen on this tour and may be estimated to be between 25 and 30 years old, are moderate yielders of small nuts.

Square planting with 60 trees to the acre has been adopted and cross drains are laid every sixth row. Fern and sedge are allowed to grow but are frequently slashed back. Although the palms are tall, only those adjacent to the drains appear to be liable to tree-fall. In this area water is found at 2 feet and clay at 4½ feet.

## North Central Malaya.

The area inspected presented several unusual features. It consists of a broad river of peat, some 200 yards in width, originating in the jungle and traversing an estate a few miles south west of Teluk Anson. The peat fills a valley in the very heavy alluvial clay which is very impervious to water and which forms a bank some four feet in height on both banks of the 'river.' The peat is overlaid with grey clay and boggy conditions are very apparent. The peat deposit is between three and four feet in thickness, and is superimposed by six inches of a mixture of clay and peat followed by six inches of heavy grey clay on top. The district was visited during a period of heavy drought, nevertheless in this area, water was met with at about 15 inches depth.

**Coconut Palms on Peat in North Central Malaya.**

| | | Sample 11 Top Soil (e) | Sample 12 Underlying Peat (e) |
|---|---|---|---|
| Loss on ignition of dried soil | ... | 12.5 | 75.1 |
| Acidity: pH unfiltered | ... | 5.1 | 5.1 |
| Acidity: pH filtered | ... | 6.8 | 6.8 |

| | | | |
|---|---|---|---|
| Age of palms—estimated ... | ... | ... | 25-30 years. |
| Condition of palms ... | ... | Health | good |
| | | Height | medium |
| Size of nuts ... ... | ... | | medium |
| Estimated yield per tree ... | ... | | 30 to 40 |
| Method of planting ... | ... | | European 55, square per acre |
| Drainage—cross drains ... | ... | | 1 every 4 rows |
| Water table (at time of visit) | ... | | 18 inches |
| Cover ... ... | ... | | grass and fern |
| Catch crops ... ... | ... | | nil |

| | | | |
|---|---|---|---|
| Description of soil | ... ... | heavy grey clay | red brown peat |
| Depth | ... ... ... | 1 foot | 3ft. to 4ft. |
| Moist or dry | ... ... ... | moist | |
| Shrinkage or tree fall | ... ... | 1ft. 6 inches shrinkage severe tree fall. | |
| Underlying soil | ... ... | probably very heavy clay. | |

The figure for *p*H indicates degree of acidity. *p*H 7.0 is practically neutral, and *p*H less than 5.5 indicates very definite acidity. The degree of harm done under Malayan conditions of a high acidity (i.e. low *p*H) remains to be ascertained, but high acidity in the soil indicates that unfavourable conditions exist.

*Drainage, Cultivation and Yields.*—From the above description, it will be seen that the conditions are more favourable to coconut cultivation than are the areas previously described. There is less chance of the soil drying up in dry weather and the top layer of clay provides food for the palms.

The palms are all of very healthy appearance, the yield of nuts may be estimated at between 30 and 40 per palm per annum. The palms, however, are leaning very acutely and serious tree-fall has reduced the probable yield of copra to about three to four pikuls per acre.

## Conclusions.

1. The observations recorded are unfavourable to "peat" as a medium for coconut cultivation. Whether this is due to excessive acidity, lack of available plant food, or to difficulties in controlling the water can only be determined by experiment. It is hoped that such experiments will be laid down in the near future in order to determine whether measures of soil amelioration will lead to a commercially profitable result.

2. It should be clearly understood that these observations which support Sampson's contentions, refer to true "peat" and not to "organic soils". Coconuts on the latter type of soil and on heavy clays in the majority of cases have given profitable yields for many years. The exact conditions for success on such soils, however, cannot yet be laid down with certitude.

3. It is emphasised that distinction must be made between deep peat and thin layers of peat. In the former case, unsatisfactory results will only be shewn after the first ten years whereas in the latter case, although severe tree-fall occurs, so reducing the yields per acre, the condition of the foliage of the remaining palms is very good and the yields of nuts are satisfactory.

4. Special attention is drawn to the extreme shrinkage which occurs in thick beds of peat as the drainage is extended and as the demands of the palms increase with growth. Usually this will cause palms that are bearing to fall, while the non-bearers remain standing, but the Javanese allow for this by the "sunken hole" method of planting.

The author wishes to thank Messrs. W. N. C. Belgrave and J. H. Dennett for the technical notes on peaty soils and for advice tendered; also Mr. F. de la Mare Norris for assistance during the tour.

# MILDEW DISEASE OF HEVEA*

BY

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The disease was first noticed by Arens in 1918 on rubber growing in the Malang District of West Java. Within a short time he showed that the disease was present throughout that country where it has since caused serious trouble. In 1925 it was reported from Malaya and Ceylon but the disease was not regarded as of serious dimensions. It is now present to a greater or lesser extent throughout the rubber growing districts of the East.

In Malaya several outbreaks were reported in 1928 and though only slight leaf fall occurred the fungus was probably more widely spread than was thought. The first serious leaf fall due to Mildew occurred after the early wintering of 1929 in the Klang—Kuala Selangor district and in northern Negri Sembilan. The rains, however, very quickly prevented further trouble that year.

In 1930, however, the long period of comparative drought in certain districts produced a very widespread attack, and of a nature so serious that the attention of estate managers was drawn to the consideration of possible effects of the disease and of means by which the disease might be controlled.

## Symptoms.

The first noticeable effect of the fungus on the leaf is that growth of the young leaves becomes arrested, the leaves wrinkle somewhat and curl or fold backwards. Discolouration then takes place rapidly from the tip downwards and the leaf falls off, though still in a soft succulent condition. The leaves fall off singly, the petiole remaining attached to the stem. In the case of Phytophthora leaf fall the three leaves and petiole fall off together.

If treatment is given or if unsuitable weather comes on during the attack the weak pendant curled leaves will recover in time to give extended, malformed, wrinkled, pale, mottled leaves, many of which may have been so weakened by the attack as to be forced off by subsequent wind or rain.

It has been frequently observed that in advanced cases when the leaf is beginning to discolour, great difficulty may be encountered in demonstrating the presence of the Oidium fungus while other secondary fungi may often be found in abundance on such specimens. It seems reasonable to suppose that the fungus ceases its activity on the leaves as soon as the leaf begins to die or as soon as the leaf has become old enough to have acquired a cuticle which, so far as this fungus is concerned, may be regarded as impenetrable.

*First part of paper read at the Second Inter-Departmental Conference, on October 29th, 1930.

The mildew fungus usually attacks only young leaves of up to 2 inches long. In other countries it is reported that older leaves may be attacked.

On the flowers and flower stalks a luxuriant growth of the fungus can often be found after a period of inclement weather even when the leaves fail to show the active fungus. It is presumed that the natural hirsute condition of the flowers affords a means of carrying over infection from one set of new leaves to the next, despite occasional heavy showers.

Infected flowers show a very distinct glistening white appearance of the glumes, they become hard and brittle and are easily shaken off. With a hand lens the conidiophores and spores may easily be seen extending beyond the hairs of the stem and flowers.

Active sporulating growths of the causal fungus may be found on flowers in known infected areas throughout the year. The writer has repeatedly demonstrated luxuriant growths of the fungus on flowers taken at various times throughout the past year from trees in a small area near Kuala Lumpur. During these investigations, living normal and germinating spores have been found in the axils of mature leaves, in the bud scales of terminal buds and upon other parts of the tree. These spores, in all probability blown from a nearby flowering tree, develop a mycelium which lies dormant until the buds throw out the fresh young leaves or flowers, when rapid growth, and production of further spores takes place on the new field of attack. Young leaves produced in the off season did not show the presence of the fungus. During the off season the heaviest infection can be found in flowers developed from the more rapidly growing terminal buds. It would appear therefore that such buds are the seat of the resting mycelium developed from wind born spores which may serve to carry over the fungus from year to year.

Microscopically the causal fungus *Oidium Heveae* shows the typical "Powdery Mildew" (Erysiphaceae) structure. A superficial, delicate, creeping, hyaline mycelium develops on the surface of the young leaves, petioles and flowers. Food is obtained from the epidermal cells by means of special feeding organs known as haustoria. From the creeping mycelium numerous short erect conidiophores are produced bearing at their tips one or more oval conidia. At ordinary room temperature (25°C-30°C) chains of 2-4 spores are often developed within two days while in cold chamber (13°C) rapid growth with the production of chains of 3-7 spores has been obtained on living Hevea flowers in the same period of time. It would appear, therefore, that optimum growth takes place at temperatures considerably lower than those normally experienced in tropical countries.

Mycelium hyaline, 4 microns wide, very much branched and septate near the junction of the branches.

Conidiophores 50-120 microns long, 6 microns wide, slightly tapered in the middle, basal cell 36-90 microns long, remainder two-septate, cutting off spores in chains.

Spores 24-36 microns long × 12-18 microns wide averaging 30 × 15

microns, oval or barrel shaped with rounded ends. Though the spores germinate easily on a dry surface in a damp atmosphere or on media they fail to continue to grow in culture after producing a germ tube some 200-300 microns long with appressoria. A living medium is essential to its continued growth. The fungus is therefore termed an "obligate parasite."

## Effects of the Disease.

The presence of the fungus in the terminal or other buds has little or no effect on the growth of the stem. Indeed an examination of such buds often reveals the presence of many different species of fungi of which a *Cercospora* sp. known to cause abnormal lenticel development and abnormal cork formation is very common, especially during dry weather.

The young shoots, however, may be repeatedly defoliated and the stems exhausted of reserve foods causing a dieback of the leading stems.

It is reasonable to suppose that this exhaustion of reserve food material of the tree is likely to retard growth considerably, while the abnormal transpiration brought about by the evaporation of water from the damaged cuticle surfaces of the leaves and stems is sure to enhance the effect of the dry weather conditions during which the fungus is most active.

The effect of the fungus on the flowers is seriously to reduce the quantity of seed. Flowers are destroyed and fall off either before opening or immediately afterwards. Most rubber trees, however, flower a second time during the year, but recent observations show that the disease may be found on flowers throughout the year. During certain months, however, the fungus was not so active as in others, and flowers formed during those months were observed to set a few fruits. In view of the fact that the most prolific seeding trees in a block of rubber kept under observation were trees obviously suffering from root disease it is preferable that seed for future planting programmes should be chosen from districts known not to have suffered from Mildew attack.

*Effect on Yield.*—So far the writer has been unable to obtain reliable information with regard to the effect of the disease on the yield of individual trees or fields of rubber. The effect of drought, wintering and disease is variously estimated at 15-30 per cent. of average monthly yield during a certain period. After examining many estate books the writer is of the opinion that the effect of drought and Mildew disease together is to produce a slightly lower yield during wintering, and to prolong the lowering in yield effect of wintering to a period of not two months but to three or even four months.

## Methods of Control.

It was early suggested that various methods of cultivation and manuring applied to the soils might enable the plant to withstand attack. Subsequent investigation, however, shows that although a more rapid recovery from the disease takes place in manured or well cultivated areas, such areas nevertheless may be just as virulently attacked as other areas.

The action of nitrogenous manures in delaying wintering may or may not be of advantage, according as the dry weather and greatest activity of the fungus come before or during the wintering of trees on such manured areas.

The breeding of varieties of Hevea immune to attack would require a long period of years before results could be expected. For present plantations, therefore, a direct attack on the fungus is the best means of control, and for this purpose the use of sulphur and sulphur compounds have in the past been proved to effect control of similar diseases of other crops and in other countries.

The use of a liquid spray is very costly in view of the high power machines required to send a fine spray jet to the required heights and the high costs of labour and transport of the large quantities of water required to make the spray mixture.

Dusting with a fungicide in the form of a fine dry powder presents the cheapest and most efficient method of controlling mildew disease.

Experience has shown that the best substance to use is sulphur dust. Sulphur dust applied at the rate of 10-12 lbs. per acre by means of a power duster is sufficient to give temporary control of the disease.

This treatment is repeated at intervals of 6 or 7 days until the refoliation period is over. Four or five such dustings will be required. An estimated cost of a season's treatment is roughly $5 per acre.

It is essential for the proper working of dusting machines that the sulphur particles be as fine and dry as possible, otherwise a cloud of sulphur dust cannot be obtained, and the sulphur falls to the ground within a few yards of the machine. A motor duster of the Bjorklund Duster type can effectively treat some 250 acres per day. For small areas various forms of hand and foot dusters are on the market, and are useful in the treatment of budwood multiplication and other nurseries to control the activities of mites and leaf spot fungi.

# THE GOVERNMENT DAIRY, COLOMBO, CEYLON

BY

B. BUNTING,

*Agriculturist.*

The original Government Dairy, Colombo, was started in 1893, but as the land which it occupied was required for other purposes a new dairy, equipped with modern buildings, was opened in June, 1921.

The dairy is situated on the outskirts of Colombo and is about 3 miles from the centre of the town. The mean maximum shade temperature is about 90°F. and the mean minimum about 70°F., giving a mean air temperature of approximately 80°F. The mean rainfall is stated to be roughly 92 inches per annum with an average of 175 rainfall days during the year.

The total area of land occupied by the farm is 85 acres. About 30 acres are reserved as paddocks for grazing, 30 acres under fodder grasses and the balance of 25 acres forming building sites.

## Livestock.

At the time of the writer's visit,* the herd consisted of 315 head of cattle, comprising 165 milch cows (98 at present in milk), 15 stud bulls, 16 draught bulls and the balance young stock.

The pure-bred Scind cattle formed the basis of the herd, but these were crossed with pure-bred Ayrshire bulls, the first cross giving excellent results.

*Cows.*—The cross-bred heifers are put to the bull at the age of 2 years and 3 months, so that they are due to calve at 3 years of age. The lactation period varies from 8 to 10 months, the heifers being put to the bull again about 2 months after calving.

There are three pure-bred imported Ayrshire heifers in the herd, but they are subject to Red-water fever (Piroplasmosis) and have not proved nearly so successful as the pure-bred imported Ayrshire bulls.

*Stud Bulls.*—There are a number of pure-bred Scind bulls and three pure-bred Ayrshire bulls imported from Scotland. Two of the Ayrshire stud bulls have been in service for over 4 years and are still quite sound. These bulls are from pedigree stock and cost about Rs. 3,000/- each, delivered in Colombo. A bull will serve up to 100 cows a year, but each stud bull is only worked once, or at the most, twice a week. A castrated bull is run with the milking herd to show which cows are in oestrum. These cows are then put to a selected stud bull. A pure-bred Scind bull always runs with the dry herd in order that any cows that have missed subsequently being covered by the pure-bred bull.

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***While on special duty in Ceylon during February, 1930 the writer visited the Government Dairy, Colombo with a view to collecting information on the working of this old established dairy which is run under the auspices of the Ceylon Government.**

*Young Stock.*—With the exception of a few specially selected heifers, which are kept at headquarters, all heifers are sent out to the Ambepusa Farm, about 40 miles away, where they are run with a pure-bred Scind bull.

## Housing Accommodation.

The general lay-out of the buildings on the farm is based on previous experience, with the result that the various cow-sheds are spaced well apart with a view to isolation. The food store is placed well outside the dairy enclosure so that draught cattle are not allowed to come inside the area occupied by the dairy herd and bring in disease from outside sources.

The cow-sheds are lean-to structures, built of heavy iron stanchions, brick backs, French-tiled roof and concrete floors, and are open at the front. They are U-shaped with an open yard, 30 feet wide, covered with concrete, having a large water tank in the centre for watering the stock and washing down the stalls. The cow-sheds are about 150 feet long and 12 feet deep with iron stanchions every 10 feet. The cows are tied up between each stanchion so that 5 feet space is allotted to each cow. The height from the ground to the eaves does not exceed 7 feet. It is important that the long axis of the cow-sheds should run east and west so that the sun passes over endways across the sheds.

The dry cows and incalf heifers are housed in a separate shed some considerable distance from the milking stock.

The stud bulls are housed in an open shed with French-tiled roof carried by iron stanchions and angle iron. The shed is divided by six-foot brick walls with an iron gate on the open front. Three rows of iron piping, 15 ins. high and 15 ins. from the wall, serve as a manger and for tying up the bulls.

The calves are housed in a 12-foot lean-to shed, which is divided by a low brick wall into 5 rooms 20 feet wide. There is a 12-foot open space in addition to the 12-foot shed and this leads to a 6-foot passage. The calves are divided into groups according to size so that they do not steal each others food. There is a large open grassed yard, about 150 ft. × 100 ft., enclosed by a 4-foot wall, in which the young stock can take exercise.

## Grazing.

The milking cows are turned out to grass for two hours after milking and before feeding, night and morning, but this is merely for exercise, since the cows are stall-fed with fodder grasses.

The dry stock are kept all day in a separate paddock, provided with shade from coconut and Jack trees, and are not allowed to mix with the milking stock.

## Feeding.

The milking herd is fed twice daily, at 8.30 a.m. and 4.30 p.m. The dry herd is only fed once a day, in the evening, so as to encourage grazing.

The present ration for a cow in full milk is made up of the following foodstuffs:—

| | | |
|---|---|---|
| 2 | lbs. | Gingelly poonac |
| 2 | ,, | Coconut |
| 1 | ,, | Linseed cake |
| 3 | ,, | Pollard |
| 1 | ,, | Dhal husks |
| 9 | lbs. | per diem |

Half the ration is fed in the morning and the other half in the evening. One ounce of salt and one ounce of sterilised bone is added to the above ration, both morning and evening. All the concentrates are soaked in cold water and fed wet in the form of porridge. Cut grass is given *ad. lib.* twice a day, immediately after feeding. In addition to this they are given a small supply of grass when grazing in the exercise paddocks.

The dry herd receive only one feed of concentrates and one feed of cut grass in addition to grazing in the paddock all day. Rice bran is given in the place of pollard for the dry herd, since it is much cheaper.

The chief grasses grown for fodder are Mauritius, Napier and Merker grass. Mauritius grass forms the staple fodder, since it is much softer and sweeter than Guinea grass and the cattle appear to relish it better.

The calves are brought into the cow-sheds at milking time and allowed to suckle a minute or two, both before and after milking, otherwise the cows withhold their milk. They are then taken back to the calf-pens and given a feed of boiled rice (kunje), pollard and a little poonac. This is placed in shallow tins and they take it as desired. They are also given plenty of fresh cut grass twice daily, which is placed in low racks. Lumps of rock salt are always kept in the calf-sheds so that the calves can take what they require.

Troughs of drinking water, in which is placed a handful of air-slaked lime, provide a continuous supply of fresh water in the calf-pens.

A "Farmer's Portable Boiler", with a capacity of 40 gallons, is used for cooking the food. This boiler was made locally and a strong cast-iron fire-box is fitted below for burning wood.

## Water Supply.

A plentiful supply of water is available from a large water tank, both for drinking and washing down the byres. Large cement tanks are placed in the centre of each yard for this purpose and a handful of air-slaked lime is added to each tank daily.

## Health of the Stock.

At the time of the writer's visit a slight outbreak of foot and mouth disease had just occurred and six cattle affected with this disease were isolated

in a temporary shed at the far end of a paddock. As a result of the presence of this disease all the walls and floors of the cow-sheds were being sprayed daily with a solution of chloride of lime and water. Tropical chloride of lime is imported in drums of 1 cwt. and one cigarette tin of this chemical is added to each bucket of water to be used for spraying purposes.

Under ordinary circumstances, Jeyes' fluid is sprayed on the walls and floors of the cow-sheds every day.

All the milking stock are washed regularly twice a week with water in an open shed specially provided for the purpose. The shed in question is 36 ft. × 24 ft. × 8 ft. and constructed of strong iron stanchions, French-tiled roof, with strong iron piping round three sides. A cement tank, 15 ft. × 4 ft. × 2 ft. deep, with two taps, provides a supply of water for washing the cattle, while a shower bath is furnished for the coolies employed on milking. The floor is of concrete and there are shallow concrete drains placed round the four sides of the shed to carry off the washing water.

All dry cows, stud bulls and young stock are dipped regularly every week, but not the milking cows, which are only washed and cleaned.

The dipping tank is approximately 50 feet long, 8 feet deep and 5 feet wide and it takes about half an hour to dip 100 head of stock. The tank holds 3,700 gallons and it requires 20 gallons of Cooper's dip, costing about Rs. 150/- to charge it. The tank is emptied and re-charged every six months, but the dip is tested regularly once a fortnight and brought up to the correct strength, namely, 1 in 200. The iodine and starch test is used with Cooper's testing outfit.

## Milking.

The cows are milked by hand and each cowman is allotted from 12 to 15 cows. The cows are milked twice a day, namely between 4 and 5 a.m. and again between 1 and 2 p.m.

At the time of the writer's visit there were 98 cows in milk and the output of milk was 285 quarts in the morning and 174 quarts in the afternoon.

A daily record is kept of the yield of milk from each cow by taking the weight of milk on a Sandringham Dairy Herd Recorder.

*Yield of Milk.*—An Ayrshire-Scind cow, first cross, gave a yield of 750 gallons of milk over a lactation period of 11 months with her first calf. The best pure-bred Scind cows give an average of 600 gallons of milk over each lactation period, the highest yield recorded being 700 gallons.

## The Dairy.

The dairy is situated some distance from the cow-sheds. It is a substantially built building, 33 ft. × 20 ft., both fly and ratproof. The roof is of French tiles and ceiled with boards. The sides are covered with white enamel tiles up to a height of 5 feet, with a cement covering on the bricks above. The floor is made of concrete with fine cement

rendering. There are four small ventilators, about the size of a brick, on each side at ground-level and these are covered with wire gauze. Shelves, 18 inches wide, made of concrete, are placed along one side. One shelf is 2 feet 6 inches high and the other about 3 inches above the floor of the dairy, with a drain all round it. The windows are in three sections, the centre one being fitted with glass and the other two with wire gauze. The top panels of the doors are also fitted with wire gauze to keep out flies.

*Sale of Milk.*—The milk is sold at the rate of 60 cents per Imperial quart and, since practically the whole of the supply is taken over by the Government hospitals in Colombo, it is all sent out in small milk-drums.

## Expenditure and Receipts.

The following is a statement of the expenditure and receipts of the dairy for the year 1928:—

| | | |
|---|---|---|
| *Receipts.* | | |
| Sale of milk ... ... ... | Rs. 92,565.51 | |
| Sundry sales ... ... ... | 7,401.79 | Rs. 99,967.30 |
| *Expenditure.* | | |
| Pay of dairy coolies ... ... | 11,591.18 | |
| Cattle food ... ... ... | 38,101.38 | |
| Stock purchases ... ... | 5,028.95 | |
| Incidental expenses ... ... | 3,732.07 | |
| Management ... ... | 4,000.00 | |
| Ground rent ... ... | 9,032.00 | Rs. 71,485.58 |
| Profit | | Rs. 28,481.72 |

The output of milk in 1928 was 39,031 gallons and the cost of production 30½ cents per bottle of 26½ oz. (1/6 gallon).

## General.

Stock sales are held twice a year, when all surplus bull calves and a few heifers and cows, of no use to the dairy herd, are disposed of. The heifers are usually kept for about 12 or 15 months before they are sold.

The working of this dairy farm is a striking example of what can be achieved in the production of fresh milk supplies under the adverse conditions prevailing on the plains in the tropics. There is no doubt that the numerous difficulties connected with such a venture have only been overcome by over 30 years of practical experience. Mr. G. W. Sturgess, the Government Veterinary Surgeon, who I understand has been in charge of the dairy since its inception, is to be congratulated on the excellent results now being obtained.

The writer wishes to acknowledge his indebtedness to the Director of Agriculture, Ceylon for arranging the visit to this dairy and also to Mr. G. W. Sturgess, Government Veterinary Surgeon, Colombo for so kindly supplying the information contained in this article.

# TOBACCO CULTIVATION IN KEDAH

BY

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*Acting Principal Agricultural Officer, Kedah.*

In recent years a tobacco industry has been established on quite a large scale in the Baling District of Kedah. A census taken during the present year showed that there were no less than 220 acres under cultivation with tobacco. It is probable that the relatively high import duty of forty dollars per pikul imposed on leaf tobacco may have given the incentive to planting the crop.

The industry is said to have been started by Chinese who brought over seed from Deli, Sumatra, and who had no doubt gained some experience of tobacco cultivation in that island.

The size of the plots planted is from ⅓ to ¾ of an acre. The chief variety is one of the large-leaved Deli kinds, which is now reproduced from seed grown locally. There is a smaller and coarser-leaved variety cultivated by the Malays for their own use; this latter type, however, is not purchased by the dealers for manufacturing purposes.

The lands on which the crop is grown are situated in the neighbourhood of limestone hills. They vary a good deal in character and may be fairly light or heavy. None of them appears to possess soil suitable for producing a high class of tobacco although the plants develop well when properly cultivated and manured. On newly cleared lands the crop is grown on ridges inter-planted with maize, but the bulk of it is planted by Chinese on lands used for vegetables also and is grown in rotation with these food crops.

The seed is sown, mixed with wood-ashes, in specially prepared nursery beds. Little trouble appears to be experienced with ants or other pests. The beds are lightly shaded with dried 'lallang' grass or other material and remain shaded until the seedlings are large enough to be transplanted—that is about one month after sowing.

The Chinese grow the tobacco in raised beds 3—4 feet wide, the soil of which is usually manured with bat guano from caves in the limestone hills. The plants are set out at 2 feet square or more. As they ripen from below upwards the leaves are cut off. The first leaves are usually harvested in 30 days from the time of planting and harvesting continues for about one month more, so that a crop is obtained in three to four months from the time of sowing.

Each well grown plant produces 25 to 30 leaves which when dried may weigh up to one-third of a pound. The plants are not topped until the inflorescence appears, but side shoots are removed as growth proceeds. In each plot a few plants are allowed to mature seed. Leaf-eating caterpillars have to be searched for daily and destroyed, but there does not appear to be any serious damage done by pests.

After harvesting, the leaves are allowed to wilt for one day and are then strung on wires, or string, and hung up in the roofs of houses or sheds to dry. There is no special provision for regulating ventilation during the drying process.

After two weeks or longer the leaves are taken down and sold to dealers at prices ranging to-day from $20/- to $25/- per pikul. Before the serious slump in prices of other local products, the usual price was $40/- to $50/- per pikul. The buyers, who are also Chinese, pack the leaves tightly in ordinary sacks and store them for six months or more, after which time they take them out, sort and strip them. The stripped leaf is then sprinkled with a small quantity of oil of anise and mixed with imported Rangoon leaf for the manufacture of cigars. The best portions of Rangoon leaf are used for wrapping purposes. The cigars, which are of poor quality, are sold to local shops in different parts of the State. To date very little leaf is used for cigarette or pipe tobacco but it is understood that machinery for preparing it for these purposes has been imported.

Reliable information regarding the yield of tobacco per acre is very difficult to obtain as spacing, growth and other conditions vary so much, but it is estimated that the yield on well cultivated and manured land should be between 1,400 and 2,000 lbs. of cured leaf per acre, say 10 to 15 pikuls. This is admittedly an estimate which is not based on actual returns, but it is considered to be quite a reasonable one.

After the leaves have been stripped of their mid-ribs and large veins it is doubtful whether the manufacturers obtain and are able to use more than one half of the weight of leaf originally purchased from the grower at $20/- to $25/- per pikul so that the actual cost to them of the leaf they can use is $40/- to $50/- per pikul plus manufacturing and other overhead charges.

## FRUITS AND OILS OF OIL PALM VARIETIES.*

Analyses are given of a number of samples of the fruits of nearly all the varieties of oil palms found in Angola; also analyses of the oils of some of these varieties. To a certain extent, the paper is a supplement to a previous one, published in 1927. General conclusions can, however, be drawn from the present figures by themselves.

To the tables giving the results of analyses are added others in elucidation thereof and also in order to discover whether correlations exist which could be utilised in factory control and in selection work.

The botanical nomenclature has, as far as possible, been confined to Chevalier's classification. The varities and types examined belonging to the species *Elaeis guineensis* Jacq. are:—*Sempernigra* A. Chev., *communis* A. Chev. types *dura* and *tenera, repanda* A. Chev., *intermedia* A. Chev., *gracelinux* A. Chev., *ceredia* A. Chev., *macrocarya* Becc., *leucocarpa* Becc., *dura virescens nigrascens* Buch and Fick. Those belonging to the sub-species *Elaeis Poissoni* Annet are:—*dura* Annet and *tenera* Annet.

Attention is drawn to the regrettable fact that a great deal of sound analytical work done in the past is of little value for purposes of comparison owing to carelessness in the use ofi specific names or to the use of vernacular names instead.

Various conclusions are drawn from the tables and attention in directed to the great variability of the fruits of any single variety of oil palm and to their general characteristics. The fruits of the thick shelled varieties are found generally to be larger and heavier than those of thin shelled varieties, but the chemical composition is usually found to differ very little. The thin shelled fruit contains a slightly greater percentage of oil, in proportion to the total weight, than the thick shelled fruit, but the average percentages of shelled kernels are fairly similar. This is not always the case, however, and it cannot be said that there are any especially rich or poor varieties of oil palm, either in respect of content of palm oil or of kernel.

High yield—of either palm oil or of kernel or of both—in proportion to the weight of the fruit, is an individual characteristic which is more frequently found among thin shelled than among thick shelled varieties; consequently even the former require careful selection for the purpose of estate planting.

The variety *macrocarya* Becc, owing to the thickness of its shell and to its not being richer in oil or in kernel than other thick shelled varieties, is not considered suitable for estate planting, but the crossing of this variety

*An abstract of "Contribution à l'élude des Fruits des Variéties de Palmiers à Huile et leurs Huiles", by Prof. C. de Mello Geraldes with the collaboration of Candido Duarte and Frederico Gouveia. *Anais do Instituto Superior de Agronomia*—Vol. III Lisbonne, 1929.

with thin shelled varieties is recommended as it might result in a new type with thin shelled fruit of large size and a high percentage of oil and kernel.

There are great differences in the proportions of water, oil and residue of the pulp of the fruit of each variety, among its fruits themselves, but the averages for these varieties differ very little. The apparently superior percentage of oil in *repanda* A. Chev. is not considered reliably proved. The oils may, however, differ in properties.

The above also holds good for the oil percentage of the kernels. Within each variety the differences are large although not quite as large as those of the oil content of the pericarp. The averages for the varieties, however, differ very little. These oils too may differ in properties.

There is no correlation between the weight of the fruits and their oil or kernel percentage, in proportion to total weight. Neither is there a correlation between the thickness or the percentage of the pulp and the palm oil percentage in proportion to total weight. The differences in oil percentage of the pulp are very large among the fruits of any single species. The figures for *communis* A. Chev. type *tenera* shew that often the pulp of the fruits that have the smaller pulp percentage has a superior oil percentage.

It would seem as if in *intermedia* A. Chev. the palm oil percentage, in proportion to the total weight, increases with the pulp percentage, but this exception has yet to be reliably proved.

There is also no correlation between the pulp percentage of the fruit and the water or residue percentages of the pulp.

The conclusion is reached that for selection as well as for factory control the only standard of comparison to be recommended is direct determination of the oil content of the pulp.

There is no correlation between the content of palm oil and of kernels in proportion to total weight: between the percentages of pulp and of kernels in proportion to total weight: between the oil percentages of the pulp and of the kernels: or between the weight of the kernels and their oil percentage. Owing to the absence of such correlations, sound selection work requires many determinations in the laboratory of physical and chemical properties.

It should, however, theoretically be possible to breed an oil palm variety having a high yield of palm oil and kernel and a high percentage of oil in the kernel. Even if the ideal type is not so evolved, selection is certain to lead to a general improvement.

According to natives of different parts of Africa, the palm oil from fruit of varieties of the sub-species *virescens* is inferior to that obtained from fruit of the *nigrescens* sub-species. The former are said to be injurious to health. This might be worth closer investigation and it would be interesting to know the opinion on this point of margarine manufacturers. Apart from this consideration, it seems to be decidedly preferable to plant *nigrescens* varieties only as the *virescens* varieties have not proved to be superior in respect of the palm oil content or of the kernel content of the fruit.

# NATIVE RUBBER CULTIVATION IN THE NETHERLANDS EAST INDIES.

*The Dutch Official publication "Korti Berichten" of October 31st, 1930 contained the Fifth Report on Native Rubber Cultivation for the first Half Year 1930, by the Division of Agricultural Economics of the Agricultural Information Service. A translation of this paper by the British Consul-General, Batavia, has just been received. The following Abstract is prepared from the translation.*

Under the pressure of low prices for rubber, the Government of the Netherlands East Indies decided to associate itself with the proposal for the cessation of tapping during the month of May and to explain the plans to the natives, with a view to bringing about voluntary co-operation between them and the European producers.

The nationalist press declared against co-operation, thinking to stir up on this score strife between the European and Native rubber industries in which the former would get the worst of it.

Native rubber planters viewed the situation from a purely economic aspect, attaching more importance to immediate advantages or disadvantages than to future expectation. The more important estate owners in Tapanoeli, the Southern and Eastern Division of Borneo and other places who were unable to work their plantations exhaustively with paid labour with low prices for the product, welcomed the proposal as participation in the plan meant to them an insignificant loss.

The small plantation owners, however, were not in favour of May restriction which they felt would deprive them of their earnings and would only bring vague advantages. The mass of small plantation owners have not participated in the restriction and it is felt that it would be difficult to induce them to embark on voluntary restriction.

At an influential meeting in May an alternative scheme was propounded viz. the voluntary co-operation of all rubber provinces on the ground of equality. Further consideration of the scheme brought to light insurmountable difficulties and it was therefore decided to approach Government with the request to change over to general legal measures of restriction as the only means of overcoming them. The decision of the Government was to the effect that it would support with advice any endeavours towards voluntary co-operation of producers but for the present at least did not feel obliged to take any legal measures of restrictions. The pronouncement was in line with the decision of the Government of Malaya after Sir Cecil Clementi's visit to the Governor-General of the Netherlands East Indies, from which it is definite that the position will be left to find its own salvation.

Supposing that the present low prices ruling will be maintained for the time being, it is therefore important to investigate what can be expected of native

rubber cultivation during the period when prices are left adjust themselves to economic conditions.

The export (in dry equivalent) of native rubber during the first seven months of 1930 was 59,582 tons as against 66,138 tons in 1929, a decrease of 6,500 tons or about 10%. The export figures for the first three months of 1930 were practically the same as for the corresponding period of the preceding year; during the succeeding months of 1930, however, the exports have steadily fallen much lower than those of 1929. The decrease is due not to the May restriction but to the suspension of tapping activities owing to the low rubber prices.

Against this fall in production stands a sharp increase in the productive area due to the fact that the large extensions in 1924 and 1925 have, to a great extent, reached a tappable age. The fact that the output has not increased by this is due to the decrease in production of the large plantations, which find more and more difficulty in obtaining tapping coolies. With the exception of the delta territories of the Western Division of Borneo, the exploitation of the large estates with coolies who receive 50 per cent. of the rubber tapped is little practised these days. A number of such estates have now altogether ceased tapping.

On the basis of the export figures available, views of a more or less speculative nature can be given on the anticipated output of native rubber taking it on the very low price unit of twenty cents (Dutch currency) per half kilogram which the market has now reached.

From a comparison of the prices of wet rubber in several places in the Outer Possessions with the prices of medium blanket at Singapore the impression is obtained that the fall in price of wet rubber is somewhat slower than that of blanket but that the average price curves tend to converge. This is to be explained by the fact that the difference between the price curve is caused *inter alia* by the water-content of the rubber and the export duty (which rises and falls with the value of the product). The fairly constant factors arising from the difference in price between the qualities are then, cost of transport, trade profits and cost of preparation of the product.

From these considerations it is clear that with the continued drop in price, the average price curve for wet rubber will strike the zero line somewhat earlier than will that of blanket quotations. In July prices for wet rubber oscillated between five and ten cents per half kilogram from a standard quotation of twenty-eight and one-half cents. The price of the last quality is now about twenty cents. Extensions of the price curves of the wet product make it appear very probable that already native rubber in unfavourably situated places in the interior is practically worthless. Further price reductions will extend the area where no native rubber can be produced at a profit until at a price around twelve cents the greater part of native rubber areas will go out of production.

Where most of the plantations will cease production before the value of rubber reaches zero, it may be taken for granted that already production has been seriously curtailed, whereby a notable shrinkage in exports must occur in the coming months.

These anticipations concerning output have been realised up to the end of September, during which month the price of twenty cents per half kilogram was reached. During this month the export of native rubber fell to a very low level. Although this can partly be ascribed to exhaustion of accumulated stocks, it can be safely said that the fall in output was one of the principal causes.

Under the guidance of the officer of the Government in their territory and the Agricultural Service the natives in the greater part of the Outer Possessions are adapting themselves to the new conditions brought about by the loss of a good portion of their earnings. By means of giving greater attention to the cultivation of vegetables the shock resulting from the collapse in rubber prices will not be so severely felt in many places as one might be inclined to suppose.

# Reviews.

## The Export Crops of the Netherlands East Indies in 1929.

*Bulletin No. 86 of the Central Bureau of Statistics, Department of Agriculture, Industry and Commerce, Buitenzorg, August, 1930.*
*pp. 266. Price 6 shillings.*

This publication gives an adequate review of the agricultural prosperity of the Netherlands East Indies as represented by the surplus products that are exported. The table given below shows the enormous increase in their total value and of the country's contribution to the world's requirements during the period 1894-1929. The rise and decline of the world's prosperity during the last 5 to 6 years of that period is reflected in these figures, the peak having been reached in 1925. In these fluctuations important parts are played by prices for Java sugar and for rubber from Java, Sumatra and Borneo.

*Export of agricultural products from estates and from native agriculture in millions of guilders.*

| Year | Java | | | Outer Possessions | | | N. E. I. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Estates | Native | Total | Estates | Native | Total | Estates | Native | Total |
| 1894 | 110 | 7 | 123 | 21 | 10 | 31 | 137 | 17 | 154 |
| 1898 | 115 | 5 | 120 | 22.5 | 10.5 | 33 | 137.5 | 15.5 | 153 |
| 1902 | 123 | 13 | 136 | 23 | 24 | 47 | 146 | 37 | 183 |
| 1906 | 148 | 16 | 164 | 21 | 27 | 48 | 167 | 43 | 212 |
| 1910 | 187 | 34 | 221 | 18 | 42 | 60 | 205 | 77 | 282 |
| 1913 | 231 | 43 | 274 | 70 | 55 | 125 | 301 | 98 | 399 |
| 1917 | 339 | 31 | 270 | 89 | 54 | 143 | 428 | 85 | 513 |
| 1921 | 516 | 65 | 581 | 133 | 101 | 234 | 649 | 166 | 815 |
| 1922 | 400 | 46 | 446 | 121 | 117 | 238 | 521 | 163 | 684 |
| 1924 | 675 | 77 | 752 | 205 | 222 | 427 | 880 | 299 | 1179 |
| 1925 | 625 | 101 | 726 | 300 | 429 | 729 | 925 | 530 | 1455 |
| 1926 | 541 | 76 | 617 | 276 | 324 | 600 | 817 | 400 | 1217 |
| 1927 | 604 | 81 | 685 | 284 | 323 | 607 | 888 | 404 | 1292 |
| 1928 | 583 | 135 | 718 | 225 | 294 | 519 | 808 | 429 | 1237 |
| 1929 | 484 | 104 | 588 | 204 | 291 | 495 | 688 | 395 | 1083 |

The increasing importance of native cultivation in relation to the total value of all produce exported from the Dutch East Indies is shown by the table given below.

*Estate-produce and Native-produce exported in percentages of total value of all Exports.*

| Year | Java | | Outer Possessions. | | N. E. I. | |
|---|---|---|---|---|---|---|
| | Estates | Native | Estates | Native | Estates | Native |
| 1894 | 94.3 | 5.7 | 67.7 | 32.3 | 89. | 11. |
| 1898 | 95.8 | 4.2 | 68.3 | 31.7 | 89.9 | 10.1 |
| 1902 | 90.4 | 9.6 | 48.7 | 51.3 | 79.7 | 20.3 |
| 1906 | 90.2 | 9.8 | 43.5 | 56.5 | 79.7 | 20.3 |
| 1910 | 84.3 | 15.7 | 30 | 70 | 72.7 | 27.3 |
| 1913 | 84.5 | 15.5 | 57.7 | 42.3 | 75.5 | 24.5 |
| 1917 | 91.6 | 8.4 | 62.4 | 37.6 | 83.1 | 16.9 |
| 1921 | 88.8 | 11.2 | 56.9 | 43.1 | 79.7 | 20.3 |
| 1922 | 89.6 | 10.4 | 50.9 | 49.1 | 76.2 | 23.8 |
| 1924 | 89.8 | 10.2 | 48 | 52 | 74.6 | 25.4 |
| 1925 | 86.1 | 13.9 | 41.2 | 58.8 | 63.6 | 36.4 |
| 1926 | 87.7 | 12.3 | 46 | 54 | 67.1 | 32.9 |
| 1927 | 88.2 | 11.8 | 46.8 | 53.2 | 68.7 | 31.3 |
| 1928 | 81.2 | 18.8 | 43.4 | 56.6 | 65.3 | 34.7 |
| 1929 | 82.3 | 17.7 | 41.2 | 58.8 | 63.5 | 36.5 |

The great recovery of the importance of the estate produce—especially in Java—during and for some time after the war is interesting. Also the increasing importance of the native produce from the Outer Possessions during the period 1902—1910 and since 1917, the latter probably chiefly due to rubber.

The proportion supplied from the Netherlands East Indies was, stated in percentages of the world's exports:

| | 1927 Per cent. | 1928 Per cent. |
|---|---|---|
| Rubber ... ... ... | 38 | 35 |
| Sugar ... ... ... | 10 | 11 |
| Coffee ... ... ... | 6 | 8 |
| Tea ... ... ... | 16 | 17 |
| Cinchona ... ... ... | 91 | 93 |
| Copra, oil, etc. ... ... ... | 23 | 30 |
| Palm oil, kernels ... ... ... | 3 | 4 |
| Fibre (sisal, cantala & magey) ... ... | 19 | 19 |
| Coca leaves ... ... ... | 58 | ? |
| Kapok ... ... ... | 76 | 79 |
| Pepper ... ... ... | 53 | 70 |

In nearly every case the percentage for 1928 shows an increase over that of 1927. A notable exception is that of rubber. An increase in the price of rubber would, however, probably again cause a large increase of the output of native rubber.

The list given above does not exhaust the number of crops successfully grown in the Netherland East Indies and for which there is a considerable export trade.

The area planted with the principal crops, with one notable exception, increased in 1929. The exception is tapioca; no reliable figures for the, by no means negligible, estate area harvested are to hand but the native area harvested in 1929, is given at 1,755,466 acres, or 108,051 acres below the average for the years 1921/28. During the last 9 years the area planted has varied greatly; it was lowest in 1926—1,679,876 acres—whereas it was highest in 1927—2,037,702 acres—or 357,826 acres = 21½ per cent. larger than the previous year.

The area and production in 1929 of some of the important crops are given below in acres and in tons of 2,240 pounds:

---

*Rubber :*

| | | |
|---|---|---|
| Hevea Estates, planted | 1,353,040 acres | |
| ,, in bearing | 890,750 ,, | 151,726 |
| ,, Native | ? | 106,874 |
| Ficus | ? | 133 |
| | Total production | 258,733 tons. |

*Cane Sugar:*

| | | |
|---|---|---|
| Estates | 472,850 acres | |
| *Native | 37,945 ,, | |
| | 510,795 acres | |
| | †Total production | 2,855,453 tons |

* part of the cane is sold to the factories, remainder consumed locally.

† factory-produce only; includes part of native cane-crop, bought by the factories.

The bulk of local native consumption is supplied from native manufacture of cane-sugar and palm-sugar.

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*Coffee:*

| | | | |
|---|---|---|---|
| *Estates, planted | 318,352 acres | | |
| in bearing | 233,242 ,, | | 54,410 |
| Native | ? | | 57,629 |
| | | †Total export | 112,039 tons |

* Includes areas with mixed crops.

† Not including local consumption.

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| | | Planted Acres | In Bearing Acres | | |
|---|---|---|---|---|---|
| *Robusta:* | Estates | 291,554 | 214,512 | 51,697 | |
| | Native | ? | ? | 51,283 | 102,980 |
| *Liberia:* | Estates | 5,800 | 4,087 | 619 | |
| | Native | ? | ? | 29 | 648 |
| *Arabica* | Estates | 13,615 | 9,837 | 1,494 | |
| | Native | ? | ? | 6,310 | 7,804 |
| *Other* | Estates | 7,383 | 4,806 | 600 | |
| | Native | ? | ? | 7 | 607 |
| Total Estates | | 318,352 | 233,242 | Total Export | 112,039 tons |

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*Tea:*

| | | | |
|---|---|---|---|
| Estates | 297,620 | | *58,883 |
| Native | 92,600 | | 15,510 |
| Total area | 390,220 acres | Total production | 74,393 tons |

* Includes produce made from leaf bought from native growers.

*Tobacco:*

| | | | | Leaf | Krossok |
|---|---|---|---|---|---|
| Estates, Java | 68,542 | | *Estates, Java | 21,290 | |
| Sumatra | 51,800 | 120,342 | *Sumatra | 19,060 | |
| | | acres. | *Java | | 16,932 |
| Native Java | 361,653 | | Native, Java | | 31,101 |
| Other | ? | ? | †Total export tons | 40,350. | 48,033 |

* Includes produce made from leaf bought from native growers.

"Krossok" is the low grade tobacco—damaged leaves, cuttings, clippings, leavings, pickings etc.—that is cut up for pipe-tobacco etc. and used for cigar-fillings.

† The figure for total export does *not* include local consumption, no figure is given for total production.

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*Cinchona:*

| | Planted Acres | In Bearing Acres | | |
|---|---|---|---|---|
| Estates | 47,886 | 37,923 | Total production | 11,697 tons dry bark |

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*Coconuts:*

| | Planted Acres | In Bearing Acres | Copra & Copra-equivalent of Oil |
|---|---|---|---|
| Estates | 127,667 | 66,434 | *26,446 tons |
| Native | ? | ? | 474,337 ,, |
| | | †Total Export | 500,783 ,, |

* Includes 2,354 tons, made from nuts bought from native growers.

† This figure does not include the local native consumption which for 1928 was estimated at 356,300 tons for Java alone and in proportion to population may be about 140,000 tons in the Outer Possessions.

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*Essential Oils:*

| | Planted Acres | In Bearing acres | | |
|---|---|---|---|---|
| Estates | 26,774 | 22,543 | | 424.5 tons |
| Native | ? | ? | | 609.5 ,, |
| | | | Total Export | 1,084 tons |

*Oil Palm* :

| | Planted Acres | In Bearing Acres | Production | | Export |
|---|---|---|---|---|---|
| Estates, Java - | 1,643 | | Oil | 35,404 | 35,312 tons |
| ,, Outer - Possessions | 140,963 | | Kernels | 6,954 | 6,729 ,, |
| | 142,606 | 58,003 | | | |

*Fibres* :

| | Planted Acres | In Bearing Acres | |
|---|---|---|---|
| Estates - | 38,753 | 28,093 acres | 15,805 tons |
| Native - | ? | ? | 41,957 tons |
| | | Total Export | 57,762 tons |

*Kapok* :

| | Planted Acres | In Bearing Acres | Kapok | Seeds | Oil | Seedcake |
|---|---|---|---|---|---|---|
| Estates - | 37,847 | 17,586 | 1,784 | 3,168 | — | — |
| Native - | ? | ? | 15,667 | 4,662 | 1,371 | 17,264 |
| | Total Export tons | | 17,451 | 7,830 | 1,371 | 17,264 |

*Cocoa* :

| | Planted Acres | In Bearing Acres | Export |
|---|---|---|---|
| *Estates - | 12,728 | 10,606 | 1,136 tons |
| Native - | ? | ? | 135 tons |
| | | Total Export | 1,271 tons |

* About 78 per cent. of this area is planted with mixed crops.

*Pepper* :

| | Planted Acres | In Bearing Acres | Export |
|---|---|---|---|
| *Estates - | 3,340 | 2,387 | 156 tons |
| Native - | ? | ? | 27,591 tons |
| | | Total Export | 27,747 tons |

About 82½ per cent. of this area is planted with mixed crops.

*Tapioca* :

| | Export. | | | | | |
|---|---|---|---|---|---|---|
| | Crude Dry Tubers | Ground Dry Tubers | Flour | Flake | Pearl | Ampas |
| Tons | 20,065 | 98,075 | 114,918 | 6,824 | 18,755 | 7,389 |

No reliable figures of the estate area can be given. Figures for the native area for 1921/9 have been given above.

*Coca-Leaf* :

| | Planted Acres | In Bearing Acres | Production |
|---|---|---|---|
| Estates - | 2,627 | 2,560 | 478 tons |

*Nutmegs* :

| | Planted Acres | In Bearing Acres | Nuts | Export Unshelled nuts | Mace |
|---|---|---|---|---|---|
| *Estates - | 5,115 | 4,095 | 496 | — | 89 |
| Native - | ? | ? | 937 | 2,380 | 591 |
| | | Total Export | 1,433 | 2,380 | 680 |

* About 44 per cent. of this area is planted with mixed crops.

*Gambier* :

| | Planted Acres | In Bearing Acres | †Export |
|---|---|---|---|
| *Estates - | 6,550 | 5,760 | 4,274 tons |
| Native - | ? | ? | 9,170 tons |
| | | | 13,444 tons |

* About 38 per cent. of this area is planted with mixed crops.

† No gambier is grown in Java which for its requirements depends on supplies from Sumatra, Riow and Borneo. The total export includes the exports to Java. The extent of local consumption is unknown.

*Gutta Percha* :

| | Export |
|---|---|
| From Java | 67 tons |
| From Outer Possessions | 2,640 tons |
| | 2,707 tons |

Practically all getah is forest produce from the Outer Possessions. There is one estate of 2,768 acres planted and in bearing in Java and two small estates in Sumatra, together 407 acres planted but not yet in bearing.

In addition to the above crops which are mainly produced for export, vast areas in the Netherlands East Indies are under crops grown for local consumption, making the country to a large extent self-supporting in the matter of food supply.

Chief of these food crops are:—

| | | | |
|---|---|---|---|
| Wet padi | ... 7,382,193 acres; | crop | 6,119,325 tons |
| Hill padi | ... 1,077,187 ,, | ,, | 531,496 ,, |
| Maize | ... 4,212,580 ,, | ,, | 1,555,511 ,, |
| Cassava (tapioca) | ... 1,755,466 ,, | ,, | 5,048,130 ,, |
| Batatas | ... 324,726 ,, | ,, | 909,055 ,, |
| Other tubers | ... 279,841 ,, | ,, | ? ,, |
| Groundnuts | ... 525,382 ,, | ,, | 153,740 ,, |
| Soya-beans | ... 435,189 ,, | ,, | 104,921 ,, |
| Other beans | ... 482,097 ,, | ,, | ? ,, |

These figures refer to Java and Madura only; for the Outer Possessions no reliable figures are available. The crop figures for cassava and batatas are given in weight of dry tubers.

Examining these figures for areas planted and crops produced, one realises that the native production in many directions is of considerable importance, not only in the matter of such crops as padi, tapioca, coconuts and other food-crops, but also in respect of such crops as rubber—of which native produce to the extent of 106,875 tons dry equivalent was exported from Sumatra and Borneo in 1929—and tobacco and sugar cane of which there were respectively 361,653 and 37,945 acres under native cultivation in Java in 1929. In respect of coffee, kapok, pepper and gambier, native production supplied respectively about 50, 80, 99 and 68 per cent. of the totals exported after satisfying local requirements.

To what extent in the Outer Possessions the growing of export crops for the world market has increased in the last few years at the expense of the former customary cultivation of food-crops for local consumption, is indicated by the following figures for the surplus of imports over exports of husked rice for the Outer Possessions only:

| | | |
|---|---|---|
| 1925 | ... ... | 298,521 tons |
| 1926 | ... ... | 338,986 ,, |
| 1927 | ... ... | 366,166 ,, |
| 1928 | ... ... | 409,356 ,, |
| 1929 | ... ... | 396,060 ,, |

The decrease in 1929 obviously is due to the decline of the price of rubber and consequent diminution of the purchasing power of the rubber producing population and their return to rice cultivation. For the chief native rubber producing countries—Riow, Jambi, Palembang and Borneo—in 1929 imported 115,991 tons of rice as against 146,588 in 1928, equivalent to 29.3 and 35.8 per cent. of the totals for the respective years.

The decrease of 30,597 tons may to a large extent be due to a probable large decrease of the number of wage-earning native tappers that are attracted to these countries from Java and adjacent territory in large numbers during periods of high rubber prices and leave again when tapping on an output sharing basis no longer pays.

A native rubber output of 106,874 tons dry weight would, at an output of 1/3 ton dry weight per tapper, require a permanent labour force of roughly 320,000 tappers. As not over three quarters of all native rubber comes from the countries mentioned, these countries employ roughly 240,000 tappers.

The labourers from outside are practically all men unaccompanied by dependents. Taking the average consumption of rice by such a labourer—including dependents if any—at 500 pounds a year, a quantity of 30,597 tons of rice represents the food for 137,000 men. The proportion of foreign labour to total employed in 1929 was certainly much below 137,000 to 240,000 among an indigenous population of about 3,750,000. So there would appear to have been a partial return to the growing of foodcrops.

Of the 1929 total of 396,060 tons of imported rice not less than 177,823 tons = 45 per cent. was imported by the Residency "East Coast of Sumatra", the centre of the large-scale capitalist rubber, tobacco and oil palm cultivation, employing practically exclusively imported labour. Banka and Billiton, which are practically entirely given to tin mining with imported labour, in 1929 imported 49,000 tons = 12½ per cent. of the total.

L. A. J. R.

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## Information Cards for Rubber Estate Factories.

The Rubber Research Institute of Malaya has recently published fifteen Information Cards which should prove of great value for general reference in rubber estate factories. The subjects of these cards include:—directions for coagulating latex; sodium sulphite; sodium bisulphite; para-nitrophenol; defective rubber sheet—bubbles, pitted surface, rust, greasy surface, dark patches, spot disease in pale crepe rubber; directions and table for standardising latex; directions for determining the dry rubber content of latex; table showing relationship between dry rubber content of latex and its specific gravity.

The cards are contained in a stiff cover supplied with two hinged rings so that further cards can be inserted when published. It is understood that the issue of further cards is contemplated. On application to the Director, Rubber Research Institute of Malaya, Kuala Lumpur, the cards will be sent free of charge, and applicants' names will be noted for the free supply of future issues of cards. The cost of the cover is thirty-five cents (Straits Settlements currency).

# Miscellaneous.

## A NOTE ON THREAD BLIGHT OF COFFEE

BY

A. Thompson,
*Ag. Government Mycologist.*

An interesting specimen of a disease of Coffee was received in August 1930. It was the affection known as Thread Blight, so called by reason of the narrow strands of white mycelium which run along the branches and leaves, often binding the leaves together.

A similar type of disease is known on Hevea and camphor in Malaya and Java, and it has also been reported on other hosts including pepper and coffee in Java and on tea in India. A thread blight also occurs on a number of fruit trees in Malaya and is frequently found on jungle plants.

Recent work on this disease (1) has shown that there are two groups of fungi which form "Thread Blights"—the Marasmioid group and the Corticium group. It is possible to distinguish these two groups by the characters of the hyphae which compose the strands. The hyphae in the coffee specimen referred to above were moderately thick walled with few septa; numerous "anchor" cells were present. For this reason the fungus is included in the Marasmioid group with "anchor" cells, and is thus similar to the fungus described on coffee in the Dutch East Indies (2), but differs from the Malayan "Thread Blight" fungus on Hevea which has no "anchor" cells.

The effect of the disease is to cause browning and death of the leaves followed by death of the branches, and on the specimen examined the green berries were also somewhat affected, being discoloured where the mycelial strands ran over the fruit.

It is stated that the fungus is more commonly found in damp localities, or under shade where the humidity is high. The infection spreads when affected leaves come in contact with healthy leaves.

The usual treatment is to reduce shade, to cut out affected branches and to burn these along with all diseased leaves. The thicker branches should be painted with 3 per cent. Izal or 20 per cent. Agrisol or with lime-sulphur mixture.

The disease has not previously been noticed on coffee in Malaya, but it is unlikely to prove serious.

References.

(1) Petch, T. Ann. Roy. Bot. Gard. Peradeniya. Vol IX. 1924-25.

(2) Bally, W. Arch. voor Koffiecult. Nederl. Indie. III. I June 1929.

# PRODUCTION OF WHALE OIL

*At a recent meeting of the Agricultural Advisory Committee a request was made for further information on the whale oil industry. In response to this request, the following details have been compiled from various sources.*

The increasing production of whale oil as well as of groundnuts and other oil seeds and nuts has an important bearing upon the copra position. This fact has been explained in an article which appeared in this Journal in February, 1930, and also in a report prepared by the Empire Marketing Board which was published in *The Tropical Agriculturist*, March 1930.

The steady increase in production shown below is further emphasised by the fact that the average annual production of whale oil between 1910—1920 was about 550,000 barrels.

The following is an abstract of a reply from the Empire Marketing Board to a recent enquiry for additional information on the production of whale oil.

The trade estimate of the quantity of whale oil coming on the market in recent years is as follows:—

| Year. | Barrels. |
|---|---|
| 1925 | 1,044,272 |
| 1926 | 1,166,857 |
| 1927 | 1,220,415 |
| 1928 | 1,356,308 |
| 1929 | 1,861,877 |

The quantities produced have been greatly increased in recent years on account of the great improvement in the methods employed in the whaling industry. Although no estimate is available of production in 1930, it is expected that heavy catches will continue unless they should result in too drastic depletion of the herds.

Owing to modern methods of treatment, a proportion of the oil can be made up into a non-odourous fat suitable for human consumption, but it is not possible to say what proportion of the whale oil available for world consumption is rendered available for edible purposes.

The following brief history of whaling and its future, was delivered by Professor A. C. Hardy in a recent wireless "talk".*

Every whale fishery has followed the same course—first a period of rapid development and profitable enterprise followed by collapse and final failure. By the fifteenth century the Basques had exterminated the Nordkarper whales from the Bay of Biscay—in the sixteenth century the Newfoundland fishery rose and fell. Then the Greenland whale was discovered and from the beginning of the

*From *The Listener*. October 1, 1930.

seventeenth century to the middle of last century a series of fisheries one after the other flourished and failed, first round the coast of Spitzbergen and Jan Mayen Land in the days of great competition between the English and the Dutch and then at Greenland and far up the Davis Straits to Baffin Bay. One by one the great British whaling ports gave up. Hull, once famous for its whaling, sent its last ship in 1869—and a few ships still sailed from Dundee till the beginning of the present century.

Just when it seemed that whaling in the north was dead, Svend Foyn, a Norwegian, in 1865 invented the modern harpoon gun. This opened up a new fishery, that of the great rorqual whales which had hitherto been too fast and powerful to be attacked. Then history repeated itself once more and for many years now only a few small stations have been operating in the north. It seemed that whaling was passing altogether from the world—but no.

Reports brought back by expeditions from the Antarctic showed that there were whales in the far south. In 1904 that great Norwegian whaling Captain—C. A. Lansen—established the first whaling stations in the south of South Georgia. In the following year floating factories visited the South Shetlands still farther south. So successful were these enterprises that by 1912 there were twenty-one whale catchers working in South Georgia and thirty-two in the South Shetlands. All these islands are part of the British Empire, being Dependencies of the Falkland Islands. The Government, realising the danger to the industry, limited the number of licences issued to the companies; but during the war when the oil became of great importance the restrictions were relaxed, and in 1915-16 the number of whales taken in a single season reached close on 12,000. If further regulations should become necessary to save the industry from decline, it was realised that it must be based on scientific knowledge. A Committee was set up with the result that the "Discovery" investigations were planned and are now being carried into practice under the leadership of Dr. Stanley Kemp. We knew practically nothing about the biology of these great whales, about their breeding habits, migrations, length of life, the time they take to reach maturity, and of the factors underlying the fluctuations in numbers from year to year. Knowledge of all these points and many others is of the utmost importance. Dr. Kemp and his staff are busy finding the answers to these questions, and much valuable information has already been obtained and is being published in the 'Discovery Reports'.

In the meantime new developments have taken place in the industry. Hitherto this whaling has been confined to shore stations or floating factories which must be anchored in the shelter of the land. A floating factory ship carries out all the operations just described, within her hull. The whales are flensed and cut up alongside—hence the necessity for calm water. But now in recent years a new type of floating factory has been evolved—it is known as a pelagic whaler, because it can carry out operations in mid-ocean. Huge jaw-like gates open in the bows or stern, revealing a sloping gullet from the

sea up to the deck. The whales brought in taken by the catchers are swallowed whole. 'Surely', as some journalist has aptly said, 'this is Jonah avenged'.

Whaling can thus be carried out without complying with local regulations. The number of whales being taken in the Antarctic is increasing every year; some forty thousand were killed during last season. The regulation of the industry of the future must depend upon international agreement, which is inevitably slow. Let us hope that it will come before it is too late. We need not fear the complete extermination of whales, because the industry is now carried out upon such a scale that it must fail before the whales are actually brought to extinction. But there is a very real danger if care is not taken, of a collapse of the industry, with the loss of this valuable supply of oil if not for ever, for a very long time to come.

## INTERNATIONAL DIRECTORY OF PEDIGREE STOCK BREEDERS.

We have recently received a copy of the third edition, 1930—31 of the International Directory of Pedigree Stock Breeders, published at 23, Fleet Street, London, E.C.4 at thirty shillings. It is essentially a register of breeders of pedigree farm stock, bloodstock, kennel-registered dogs and pedigree poultry in Great Britain and Ireland, the British Dominions and Colonies and in many other countries. The book also contains other information on stock in many countries and is suitably illustrated.

# Departmental.

## FROM THE DISTRICTS.

### The Weather.

In most parts of the country the month was wet, rainfall being well distributed. In Malacca, however, the weather was fairly dry with occasional heavy storms, while in Pahang some districts received much less rain than others.

### Remark on Crops.

*Rubber.*—There was a slight rise in the price of rubber, smoked sheet from small holdings selling for \$13—\$18 and unsmoked sheet for \$10—\$16 a picul. In Singapore the number of small holdings not tapped is increasing while in Negri Sembilan tapping has been resumed on a few holdings. Elsewhere there have been no changes worthy of record.

As was to be expected during the continued wet weather, Mouldy Rot disease has been much in evidence.

*Padi.*—With an adequate water supply for two months the prospects for the coming padi harvest have greatly improved and at present satisfactory or good crops are expected in most cases. Harvesting was in progress in Temerloh District of Pahang and had commenced in one locality in Selangor. Minor floods did a little local damage in various parts of the country. Some good crops of dry padi were harvested in Kedah and Selangor. The dry padi areas in Perak South and Pahang West have not yet been reaped.

In certain localities in Kedah and Province Wellesley where the water was deep, the caterpillars of the small moth *Nymphula depunctalis* proved troublesome as a minor pest, since the deep water renders control difficult. The leaf hopper, *Sogata pallescens*, appeared again in a few localities in Krian and Kuala Kangsar Districts, damaging an area of 150 acres of padi in Krian. Stem borers did some damage in Selangor and the padi fly *Leptocorisa acuta* was also found in several localities but did not occasion much loss.

*Food Crops.*—In Kedah attention continued to be given to the planting of food crops which include an area of about 35 acres planted with the Bambarra groundnut in Kulim District.

*Fruit.*—In Klang and Kuala Langat Districts of Selangor local fruit trees were in bearing including durians, rambutans and pulasans. Crops, with the exception of durians, were poor and prices not attractive. In the inland Districts fruits were not yet ripe. In Pahang West further small supplies of the same fruits ripened in Raub and Bentong Districts. In Seremban District there was a good crop of bullock's Heart (*Anona reticulata*) and a small crop of durians, but the quality was poor.

*Pineapples.*—The supply of pineapples in Singapore island has been quite insufficient to keep the five factories working. The price paid for fresh fruit delivered at the factory ranged from 80 cents to \$1.20 a hundred and provided little encouragement for increasing the planted area.

*Cloves.*—The clove harvest in Penang commenced during the month. Dried cloves were selling at \$40 a picul as compared with \$60 in 1929.

*Other Crops.*—In Batang Padang District of Perak considerable interest is being taken by small-holders in crops such as coffee, tuba, bananas and tobacco. Certain newly alienated lands have been planted in an orderly manner with the first three crops mentioned. It would appear that this is in a great measure due to the lectures which have been given on various subjects and to the policy adopted of getting in touch with successful applicants for land.

## Notes on Demonstration Station and Padi Test Plots.

*Kedah. Rice Experiment Station.*—The plots were weeded and supplied. The plants continued to make satisfactory growth.

*Glugor Padi Test Plot, Penang.*—The work of preparing the land proceeded rapidly and all varieties, except the short period padi, Radin Siak, had been planted out at the end of the month. Heavy rains did slight damage to one or two plots. Rats and the insect *Scotenophora coarctata* also did slight damage in one or two plots, but control measures were successful.

*Bukit Merah Padi Test Plots, Province Wellesley.*—Planting was completed during the month and the station looked remarkably well. The water supply was ample.

*Seremban Fruit Nursery.*—Two beds were planted with carpet grass to produce cuttings for School Gardens from which there is an increasing demand. A row of pomegranates was planted out and the planting of cover crops was continued. *Centrosema pubescens* and *Calopogonium mucunoides* were cut and used as a mulch round the citrus trees after the ground had been forked. The growth of the recently planted Salisbury White Sweet Corn was good.

*Kuala Lipis Demonstration Station.*—A few seedlings of a considerable number of different fruit trees were planted out. Marcots were made from the grape fruit trees and all the plants on the plot of citrus trees were pruned. Of food crops, plots of two varieties each of maize, groundnuts, soya beans and sweet potato were planted.

*Sungei Ledang Demonstration Station, Malacca.*—Felling was completed and preliminary plans for the layout of the station were drawn up.

*Pineapple Demonstration Station, Singapore.*—Clearing, fencing and roading of this station was commenced. Arrangements were in progress for the erection of the buildings.

## Rat Destruction.

In Province Wellesley payments were made for 271,506 rat tails, bringing the total number of rats accounted for during the year up to 1,294,916. The number of baits distributed was 27,235. In Krian rewards were paid for 563,579 tails making a total for the year of 1,757,735. In Malacca 29,534 tails were paid for.

In many places rats are far more numerous than usual, so that in spite of the large numbers destroyed, some damage has been caused to padi in Krian and in localities adjoining uncleared land in Province Wellesley North.

# DEPARTMENTAL NOTES.

## The Director of Agriculture visits Pahang and Johore.

The Director of Agriculture toured Pahang and Johore in connection with the investigations of the Rice Cultivation Committee from November 6th—11th inclusive.

## Visits to the Department.

Mr. C. F. Pemberton, Chief Entomologist, Sugar Planters' Association of Hawaii arrived in Malaya about the 8th August, with a view to finding and then introducing into Hawaii parasites to control some sugar cane insect pests. He has been stationed at the Government Experimental Plantation, Serdang, since his arrival. Mr. Pemberton has been successful in obtaining an egg parasite of a grasshopper—*Oxya chinensis*—and it is understood has already sent shipments of the parasite to Hawaii where this grasshopper has caused some damage to the crop.

Mr. H. J. Page, Senior Chemist of Imperial Chemical Industries Ltd., visited the Department in November. Mr. Page is touring the Peninsula with a view to studying the local demand for chemical manures.

Dr. (Miss) Müller of the Biolaboratorium, Oppau, Baden, Germany, visited the Department of Agriculture at Kuala Lumpur on October 30th and 31st, 1930. Dr. Müller is on an official tour studying economic food crops with special reference to a botanical survey of Soya Bean.

## Mr. E. A. Curtler's visit to India and Ceylon.

Mr. E. A. Curtler, Assistant Agriculturist, returned to Malaya on 20th October, 1930, after a six months' tour in India and Ceylon, which was undertaken for the purpose of studying tea cultivation as practised in those countries. It is hoped to publish in this Journal Mr. Curtler's observations on the subject of his investigations.

## Appointment.

Mr. B. A. Lowe, B.A., was appointed an Assistant Economic Botanist, Department of Agriculture, S.S. & F.M.S. on 16th October, 1930. Mr. Lowe reported for duty on 13th November, 1930.

## Leave.

Mr. F. R. Mason, Agricultural Field Officer (Province Wellesley and Penang) has been granted seven months and twenty-six days leave on full pay, with effect from the 20th November, 1930, inclusive.

Mr. J. Fairweather, Agricultural Field Officer (Malacca) returned from leave of absence on 8th November, 1930. Mr. Fairweather proceeded to Butterworth on 17th November to take over the duties of Mr. Mason during the latter officer's absence on leave.

## Statistical.

# MARKET PRICES.

### November, 1930.

*Rubber.*—The average price in Singapore was 14.2 cents per lb. against 12.6 cents in October. The average London price for November was 4.4d. compared with 3.96d. for the previous month.

*Palm Oil.*—Market quiet. London advised on 27th November that the price on that day was £16.15.0 per ton, on a basis of 18% F.F.A.

*Copra.*—Firmer. Singapore average prices for November: Sundried, \$6.32½; Mixed, \$6.00; Cake, \$1.75 per picul. Corresponding prices in October were \$6.22; \$6.01; \$1.75.

*Gambier.*—Demand negligible. Average Singapore prices: Block, \$9.08; Cube, \$14.25 per picul against \$9.37½ and \$14.25 respectively in October.

*Nutmegs.*—Market has declined, but is fairly steady at lower prices. Average Singapore prices for November: 110's \$26.87½; 80's \$31.12½ per picul against \$29.40 and \$32.70 respectively in October.

*Mace.*—Average Singapore prices: Siouw, \$83.12½; Amboina, \$60 compared with corresponding prices for October of \$90.50 and \$67.50 per picul.

*Pepper.*—Market firm and considerable business passing. Average prices for November: Singapore Black, \$23.75; White, \$39.50; Muntok, White, \$41.37½ compared with \$24.80; \$39 and \$41 per picul respectively in the previous month.

*Sago.*—Steady. Average Singapore prices for November: Flake, small, fair, \$6.50; Flour, Sarawak, fair, \$3.05 per picul against \$6.19 and \$2.99 respectively in October.

*Tapioca.*—Market firmer. November average prices in Singapore were:—Flake, Small fair, \$4.47½; Pearl, seed, \$5.81; Pearl, Medium, \$6.50. Corresponding prices for October: \$4.24; \$5.65; \$5.95 per picul.

*Pineapples.*—Very little business passing. Average Singapore prices per case in November: 1½ lb. cubes, \$3.28; 1½ lb. flat, \$3.18¾; 1½ lb. tall, \$3.65 compared with \$3.40; \$3.34; and \$3.76 respectively in October.

The above prices are based on London and Singapore quotations for rubber and on the Singapore Chamber of Commerce Market Reports published in November. Palm oil quotations are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd.

1 picul = 133 1/3 lbs.

The dollar is fixed at two shillings and four pence.

# MALAYA RUBBER STATISTICS.

**Stocks of Rubber, including Latex, Concentrated Latex and Revertex, held by Dealers and Estates of 100 Acres and over, the Declared Production of the same Estates, Imports and Exports, and the Estimated Production of Estates of less than 100 Acres, for the Month of October 1930, in Dry Tons.**

| Territory | Stocks at beginning of month | | | Production by estates of 100 acres and over | | Production by estates of less than 100 acres (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | during the month | | during the year 1930 | | during the month | | during the year 1930 | | | | |
| | Ports | Dealers | Estates of 100 acres and over | during the month | during the year 1930 | during the month | during the year 1930 | Foreign | From Malay States | Foreign | From Malay States | Foreign | Local | Foreign | Local | Dealers | Estates of 100 acres and over | Ports |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| **Malay States** | | | | | | | | | | | | | | | | | | |
| **Federated Malay States** ... ... | ... | 10,594 | 15,959 | 12,701 | 114331 | 8,108 | 93,055 | Nil | 7 | Nil | 59 | 16,003 | 6,083 | 153923 | 54,953 | 10,036 | 15,247 | ... |
| **Johore** ... ... | ... | 2,013 | 5,040 | 4,019 | 35,293 | 4,096 | 39,215 | Nil | 5 | Nil | 19 | 1,362 | 6,808 | 10,634 | 64,845 | 2,196 | 4,807 | ... |
| **Kedah** ... ... | ... | 436 | 2,208 | 2,196 | 19,436 | 1,067 | 12,008 | Nil | Nil | 30 | Nil | 892 | 2,239 | 7,568 | 23,863 | 464 | 2,312 | ... |
| **Perlis** ... ... | ... | 10 | 8 | 7 | 81 | 15 | 129 | Nil | Nil | Nil | Nil | Nil | 21 | Nil | 223 | 10 | 9 | ... |
| **Kelantan** ... ... | ... | 182 | 158 | 226 | 2,511 | 425 | 3,809 | 2 | Nil | 33 | Nil | 114 | 548 | 742 | 5,639 | 163 | 168 | ... |
| **Trengganu*** ... | ... | 55 | 50 | 97 | 1,148 | 48 | 573 | Nil | Nil | Nil | Nil | Nil | 145 | Nil | 1,722 | 55 | 50 | ... |
| **Straits Settlements** | | | | | | | | | | | | | | | | | | |
| **Malacca** ... ... | ... | 2,606 | 1,957 | 1,362 | 12,010 | | | Nil | 3,243 | Nil | 18,835 | 5,578 | | 40,591 | | 2,516 | 1,907 | ... |
| **Province Wellesley** | ... | 131 | 709 | 542 | 4,596 | † | | | | | | | | | | 117 | 686 | ... |
| **Dindings** ... ... | ... | 89 | 145 | 93 | 975 | 1,086 | 31,217 | 393 | 3,118 | 7,256 | 33,201 | 5,896 | Nil | 56,140 | Nil | 96 | 117 | ... |
| **Penang** ... ... | 1,876 | 5,266 | 15 | 8 | 102 | | | | | | | | | | | 4,136 | 13 | 1,258 |
| **Singapore** ... .. | 4,954 | 28,526 | 324 | 224 | 2,278 | | | 5,683 | 9,471 | 87,202 | 99,131 | 18,064 | | 202,363 | | 27,614 | 347 | 3,476 |

**Analysis of Colony, Federated Malay States and Johore Dealers' Stocks at End of Month, in Dry Tons**

| Class of Rubber (20) | Federated Malay States (21) | Singapore (22) | Penang (23) | Province Wellesley, Dindings and Malacca (24) | Johore (25) | Gross total (26) |
|---|---|---|---|---|---|---|
| Smoked sheet ... | 7,217 | 15,121 | 2,467 | 1,664 | 970 | 27,439 |
| Crepe ... ... | 572 | 10,477 | 1,128 | 723 | 255 | 13,155 |
| Unsmoked sheet ... | 1,220 | 2,016 | 541 | 342 | 578 | 6,117 |
| Scrap and lump ... | 1,027 | | | | 393 | |
| Total all Grades ... | 10,036 | 27,614 | 4,136 | 2,729 | 2,196 | 46,711 |

**Notes.**—1. **Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.**

2. **The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10).**

3. **Colony Dealers' Stocks are as published in Return I. & E. 6, dated 10 November, (S. S. *Gazette* Not. No. 2350), being dry weight as estimated by Dealers themselves.**

4. **Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked Sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.**

5. **Foreign Imports are as published in Return I. & E. 5, dated November 3, (S. S. *Gazette* Not. No. 2283), foreign wet imports being reduced to dry weight by 25 per cent.**

6. **Foreign exports of each State and Settlement are those published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I. and E. 4, dated November 4, *Gazette* Not. No. 2282 Appendix IV to Monthly Trade Return).**

*7. **Stocks and production in Trengganu are estimated from figures supplied by the Commissioner of Lands.**

8. **All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.**

†9. **This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the Columns comprising it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.**

**Singapore, November 19, 1930.**

J. I. Miller, M.C.S.,
*Acting Registrar-General of Statistics, S.S. and F.M.S.*

# SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES, STRAITS SETTLEMENTS AND KEDAH FOR THE MONTH OF OCTOBER, 1930.

| State | District | Acreage of padi land | Acreage planted | Percentage 4 to 3 | Gross crop | Crop per acre 6 to 4 | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | Gantangs | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Perak** | Perak North : | | | | | | |
| | Krian | 53,250 | ... | ... | ... | ... | About 20,000 acres planted. |
| | Larut | 8,525 | ... | ... | ... | ... | Planting nearing completion. |
| | Selama | 3,450 | ... | ... | ... | ... | Planting nearing completion. |
| | Kuala Kangsar | 13,997 | ... | ... | ... | ... | Planting nearing completion. |
| | Upper Perak | 3,739 | ... | ... | ... | ... | Planting practically completed. |
| | Perak South : | | | | | | |
| | Eight mukims | 14,817 | ... | ... | ... | ... | Planting completed in four mukims. Menajak in process in the rest. |
| | | 97,778 | ... | ... | ... | ... | |
| **Selangor** | Ulu Langat | 2,670 | ... | ... | ... | ... | Flowering commenced. |
| | Kuala Lumpur | 797 | ... | ... | ... | ... | Flowering commenced water drained off in S. Buloh. |
| | Ulu Selangor | 1,205 | ... | ... | ... | ... | Flowering commenced. |
| | Kuala Selangor | 18,564 | ... | ... | ... | ... | Tanjong Karong and Sekenchan—694 acres abandoned. Flowering commenced in Jeram. 4710 acres Cultivators are awaiting favourable conditions to transplant rest of the area. |
| | | 23,236 | ... | ... | ... | ... | |
| **Negri Sembilan** | Seremban | 4,904 | ... | ... | ... | ... | One to three months old. |
| | Kuala Pilah | 17,931 | ... | ... | ... | ... | Planting and weeding in progress. |
| | Port Dickson | 159 | ... | ... | ... | ... | Transplanting completed. |
| | Jelebu | 3,116 | ... | ... | ... | ... | Flowering commenced. |
| | Tampin | 2,609 | ... | ... | ... | ... | Three months old. |
| | Rembau | 7,897 | ... | ... | ... | ... | Weeding. |
| | | 36,616 | ... | ... | ... | ... | |

SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES, STRAITS SETTLEMENTS AND KEDAH FOR THE MONTH OF OCTOBER, 1930.—(Continued).

| State or Settlement | District | Acreage of padi land | Acreage planted | Percentage 4 to 3 | Gross crop | Crop per acre 6 to 4 | Remarks |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | | Gantangs | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Pahang** | Temerloh | 12,311 | ... | ... | ... | ... | Flowering up to five months planted. |
| | Raub | 5,112 | ... | ... | ... | ... | Transplanting to four months planted. |
| | KualaLipis | 8,450 | ... | ... | ... | ... | River mukims five months old—Rest transplanting completed. |
| | Bentong | 1,100 | ... | ... | ... | ... | Up to four months planted. |
| | | 26,973 | ... | ... | ... | ... | |
| **Straits Settle-ments** | Malacca, Central | 16,473 | ... | ... | ... | ... | One to three months planted. |
| | Alor Gajah | 11,136 | ... | ... | ... | ... | One to two months old. |
| | Jasin | 5,756 | ... | ... | ... | ... | Transplanting in progress. |
| | | 33,365 | ... | ... | ... | ... | |
| | P. Wellesley, North | 18,560 | ... | ... | ... | ... | Planted. |
| | Central | 10,519 | ... | ... | ... | ... | Planting in progress. |
| | South | 4,649 | ... | ... | ... | ... | Clearing still in progress and planting commenced. |
| | | 33,728 | ... | ... | ... | ... | |
| | Penang | 4,000 | ... | ... | ... | ... | Planting completed. |
| | Singapore | nil | ... | ... | ... | ... | |

SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES, STRAITS SETTLEMENTS AND KEDAH FOR THE MONTH OF OCTOBER, 1930.—(Continued).

| State (1) | District (2) | Acreage of padi land — Acres (3) | Acreage planted — Acres (4) | Percentage 4 to 3 (5) | Gross crop — Gantangs (6) | Crop per acre 6 to 4 (7) | Remarks (8) |
|---|---|---|---|---|---|---|---|
| **Kedah** | K. Star | 105,060 | ... | ... | ... | ... | Planting in progress. |
| | Langkawi | 4,908 | ... | ... | ... | ... | |
| | Padang Terap | 6,637 | ... | ... | ... | ... | |
| | Kubang Pasu | 35,094 | ... | ... | . | ... | |
| | Kuala Muda | 13,267 | ... | ... | ... | ... | |
| | Baling and Sik | 19,156 | ... | ... | ... | ... | |
| | Kulim | 3,642 | ... | ... | ... | ... | |
| | Bandar Bahru | 2,528 | ... | ... | ... | ... | |
| | Yen | 19,748 | ... | ... | ... | ... | |
| | | 210,040 | ... | ... | ... | ... | |

N.B.—The figures given in the latest return under column 3 may be accepted as more accurate than any given in previous returns.

J. GORDON-CARRIE,
Statistician.

# METEOROLOGICAL SUMMARY, MALAYA. OCTOBER, 1930.

| Locality | Air Temperature in Degrees Fahrenheit: Means of A. Max. | B. Min. | Mean of A and B | Absolute Extremes: Highest Max. | Lowest Min. | Lowest Max. | Highest Min. | Earth Temperature: At 1 foot | At 4 feet | Rainfall: Total | | Most in a day: Amt. | Number of days: Precipitation* | Precipitation, 1mm. or more | Thunder-storm | Thunder heard | Fog morning obs. | Gale force 8 or more | Bright Sunshine: Total | Daily Mean | Per cent | Length of Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °F | °F | °F | °F | °F | °F | °F | °F | °F | in. | mm. | in. | | | | | | | hr. | hr. | % | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 89.8 | 71.6 | 80.7 | 94 | 69 | 82 | 74 | 82.9 | 83.6 | 15.53 | 394.5 | 3.07 | 29 | 27 | 6 | 19 | 8 | | 154.25 | 4.97 | 41 | 12.1 |
| Bukit Jeram, Selangor ... | 88.0 | 72.4 | 80.2 | 92 | 71 | 80 | 74 | 84.9 | 87.3 | 8.30 | 210.8 | 1.99 | 27 | 22 | 2 | 15 | 8 | | 181.65 | 5.86 | 48 | 12.1 |
| Sitiawan, Perak ... | 88.5 | 72.9 | 80.7 | 92 | 71 | 85 | 75 | 84.2 | 84.6 | 8.62 | 218.9 | 2.56 | 24 | 20 | 12 | 17 | 2 | | 195.10 | 6.29 | ... | ... |
| Kroh, Perak ... | 95.9 | 70.5 | 78.2 | 89 | 68 | 80 | 72 | 79.5 | 82.2 | 21.86 | 555.3 | 2.14 | 29 | 28 | ... | 12 | 18 | 2 | 163.00 | 5.26 | ... | ... |
| Temerloh, Pahang ... | 89.2 | 72.7 | 80.9 | 92 | 71 | 81 | 74 | 84.6 | 86.0 | 24.23 | 615.5 | 8.60 | 22 | 19 | 3 | 23 | 5 | | 179.80 | 5.80 | 48 | 12.1 |
| Kuala Lipis, Pahang . | 88.9 | 71.6 | 80.3 | 91 | 69 | 82 | 74 | 83.5 | 84.4 | 11.35 | 288.3 | 2.47 | 25 | 19 | 13 | 17 | 20 | | 172.75 | 5.57 | ... | ... |
| Kuala Pahang, Pahang ... | 95.5 | 73.7 | 79.6 | 89 | 70 | 78 | 76 | 84.4 | 86.8 | 13.06 | 331.7 | 4.11 | 24 | 20 | 3 | 9 | ... | | 198.30 | 6.40 | 53 | 12.1 |
| Cameron's Highlands, Rhododendron Hill, Pahang ... | 70.5 | 59.3 | 64.9 | 73 | 53 | 66 | 61 | ... | ... | 23.09 | 586.5 | 2.64 | 30 | 29 | 1 | 4 | 1 | | 113.25 | 3.65 | 30 | 12.0 |
| Cameron's Highlands, Tanah Rata | 71.2 | 57 2 | 64.2 | 74 | 54 | 68 | 61 | 69.8 | 69.8 | 23.93 | 607.8 | 2.84 | 30 | 29 | 1 | 10 | 1 | | 119.95 | 3.87 | 32 | 12.0 |
| Fraser's Hill, Pahang ... | 73.1 | 61.7 | 67.4 | 77 | 60 | 70 | 63 | 71.0 | 71.4 | 20.05 | 509.3 | 2.03 | 29 | 29 | .. | 20 | 17 | | 146.75 | 4.73 | 39 | 12.0 |
| Mount Faber, Singapore ... | 87.5 | 74.2 | 80.9 | 92 | 71 | 77 | 76 | 82.2 | 83.6 | 9.24 | 234.7 | 3.01 | 18 | 13 | 2 | 17 | ... | | 164.30 | 5.30 | 44 | 12.1 |
| Butterworth, Province Wellesley | 86.5 | 73.7 | 80.1 | 89 | 73 | 83 | 75 | 84.1 | 84.8 | 15.01 | 381.3 | 3.68 | 27 | 25 | ... | 22 | ... | | 197.80 | 6.38 | ... | ... |
| Bukit China, Malacca .. | 34.2 | 73.3 | 78.7 | 87 | 72 | 81 | 74 | 83.1 | 84.5 | 5.64 | 143.3 | 1.13 | 21 | 20 | ... | 2 | ... | | 198.50 | 6.40 | 53 | 12.1 |
| Kluang, Johore ... | 87.6 | 71.2 | 79.4 | 91 | 68 | 80 | 74 | 81.0 | 82.0 | 18.03 | 458.0 | 3.08 | 27 | 25 | 2 | 15 | 19 | | 151.10 | 4.87 | 40 | 12.1 |
| Bukit Lalang, Mersing, Johore... | 86.1 | 71.7 | 78.9 | 90 | 69 | 78 | 73 | 81.6 | 82.2 | 7.81 | 198.4 | 1.65 | 17 | 15 | 1 | 14 | ... | | 189.05 | 6.09 | 50 | 12.1 |
| Alor Star, Kedah ... | 87.4 | 73.7 | 80.5 | 93 | 71 | 81 | 76 | 85.8 | 86.0 | 16.90 | 429.3 | 3.17 | 27 | 23 | ... | 11 | ... | | 202.65 | ... | ... | ... |
| Kota Bharu, Kelantan ... | 86.5 | 73.6 | 80.1 | 89 | 72 | 79 | 76 | 84.6 | 85.5 | 8.85 | 224.8 | 3.18 | 22 | 18 | ... | 9 | ... | | 182.00 | 5.87 | ... | ... |
| Kuala Trengganu, Trengganu... | 85.7 | 73.1 | 79.4 | 89 | 71 | 80 | 75 | 83.7 | 84.9 | 5.60 | 142.3 | 1.51 | 26 | 21 | ... | 8 | 2 | | 176.05 | 5.68 | ... | ... |

* Precipitation ·01 inch or more when measurement is in inches ·2mm. or more when measurement is in millimetres.

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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